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ORGANISING SCIENTIFIC RESEARCH.

LITTLE is known of the attempt to form a Scientific Research Association, and still less, probably, that the attempt came to a premature end at the British Association meeting at Bournemouth. This event in the scientific world has arisen because certain scientific people felt very strongly that industrial research was being concentrated upon too much by the Department of Scientific and Industrial Research, and that scientific research *per se* was in danger of being swamped in the process. The aim of the projected Scientific Research Association was to organise scientific research, and to formulate a scheme for the State endowment of such research. The criticism immediately met with, when the suggestion to form this new association was made, was—why establish a new organisation? Why should not some existing society do it; the Royal Society, the British Association, or the British Science Guild? The answer of the promoters was that the Royal Society would not do it, and, indeed, its constitution was quite unsuitable, because, although it received a grant of £5,000 a year for research, it merely made grants after inquiry as to whether they were justified by the particular researches proposed. Moreover, the association of younger men who have not yet become Fellows is an important feature of any scheme that aims at being really representative. The British Association might do it if it would consent to reorganise its constitution and permanent staff for the purpose—perhaps a good deal to ask—whilst the British Science Guild was understood to regard any such detailed organisation of research as not within its sphere, though it looked upon the proposal to create such an organisation with sympathy and approval.

Having answered their own questions in this way, those concerned proceeded to take the necessary preliminary steps to bring the Scientific Research Association into being. In the spring of this year a Provisional Committee was appointed, and a circular was sent round to about 2,000 people who were thought likely to give their support. To be perfectly candid, the whole thing fell flat, for although between 150 and 200 supporters were found, there were some eminent people who held that the work of the proposed new organisation ought to be done by existing bodies. Consequently, it became evident that the estimated sum of £1,500 to £2,000 per annum, necessary to pay the salary of a general secretary and office and secretarial expenses, did not seem likely to be forthcoming; and the promoters were at something approaching a deadlock. It was in these circumstances that advantage was taken of so large a number of scientists being in Bournemouth in connection with the British Association to hold a meeting to discuss the position, although it must be understood that the meeting was not in any way convened by the British Association. That meeting, it must be confessed, was quite unrepresentative, and it was clear, from the lack of practical support which was experienced, that there was nothing to do but abandon the idea, which, by the way, had its origin in Cambridge, and the Provisional Committee, which was appointed to carry out the preliminary work, consisting entirely of members of that University, though with powers of co-option.

There appears to be a general agreement that scientific research needs to be looked after and co-ordinated by some organisation, but a strong doubt exists as to whether it is

necessary to bring a new organisation into existence for the purpose. Strictly speaking, it should be the work of the Department of Scientific and Industrial Research to do this, but some distrust of that body seems to have crept into the minds of scientific workers who view, with a certain amount of jealousy, the great attention which is being bestowed on industrial research by the Department.

Precept and Practice.

Now, when it is the order of the day for leaders in industry to turn their attention to the problems of industrial reconstruction, it will be interesting to see whether the electric supply industry will make any notable contribution. Up to the present, two have entered the field, one in the region of precept, the other in the more restricted domain of practice. For the first, Mr. Emile Garcke, with a view to adjusting the claims of Capital and Labour, throws out for consideration, in a recent issue of the *Nineteenth Century*, a somewhat comprehensive proposal to "pool profits" and to distribute among "all who have contributed to produce it, according to their claims, rights, and deserts." This is the type of co-partnership scheme which, he thinks, offers the greatest hope of a permanently satisfactory settlement, providing, as it does, a "complete fusion of interests" between Capital and Labour. The failure of co-partnership schemes up to the present has been due, he considers, to the fact that "Labour has not been identified with the whole of the profit remaining after all the costs of production have been defrayed." As to what are to be taken as "profits," this it will be the duty of a "Ministry of Profits" to decide. Under this scheme, management is to be left, of course, to private enterprise, with the augmented "lure of profits" as a stimulus. (Not an overwhelmingly powerful "lure" in the case of the electric supply industry at present!). This, therefore, is the panacea of Mr. Garcke for the fundamental grievance of Labour. Now for the less ambitious venture in the realm of practice. Mr. Napier Prentice in his modest East Coast undertaking has essayed with something of the same idea in mind. With the object of enabling "workmen to realise that they are working not only to benefit the ordinary shareholders," he has issued a special series of "Workmen's Shares," to be paid for out of profits and distributed as free gifts in proportion to years of service. We may, therefore, assume at least theoretical sympathy of intention between Mr. Prentice and Mr. Garcke, allowing for the difference of atmosphere between the practical responsibilities of a board room and the unembarrassed liberty of the columns of a review.

The Tramway Situation.

The shrewd and pertinent questions put forward by Councillor Kelly at the Conference of the Municipal Tramways Association, last week, reveal a breadth of mind and a practical insight worthy of the convener of the Glasgow Corporation Tramways Committee, and deserve the careful attention of every tramway manager. No doubt most managers have had some or other of these questions very sharply pressed upon their notice by force of circumstances, but the whole subject of electric traction requires thorough consideration in the light of the new conditions that now obtain. Before the war electric tramway practice had to a great extent settled down into well-worn lines, and if it had not actually reached stagnation, it certainly showed little tendency towards enterprise and new departures. The time has now arrived when every effort must be put forth to improve the services and to reduce their cost, while important and fundamental questions of policy must be decided.

Valuable light is thrown on a very important aspect of this subject by Mr. A. R. Fearnley, in his paper on "Motor-Omnibus Services." With some six years' experience of motor-omnibuses as adjuncts to the tramways of the Sheffield Corporation, he shows that the 'bus is an excellent feeder and interconnector to the tramways, but is quite unsuitable for heavy town traffic, and incapable of dealing adequately with peak loads. The omnibus service costs nearly three times as much per passenger as the tramway service, and the fares charged are much more than double; these are facts which leave no room for argument as to whether the 'bus will supplant the tramway. But as an auxiliary to the tramway the omnibus has most valuable functions to fulfil, and does so very efficiently.

Why the municipalities which employ motor-omnibuses in this way rigidly confine their attention to petrol-driven vehicles we do not understand. The electric battery vehicle for heavy service has proved its worth, and municipal authorities eagerly purchase them when they have the opportunity. The suburban motor-bus service outlined by Mr. Fearnley is of a kind for which the battery vehicle is admirably adapted, and the cost of energy for battery charging is well-known to be a minor item of expense, whereas the cost of petrol is a very heavy one—nearly one-third of the total cost. That an electric tramway, with electrical energy available at every point of the system, should employ internal-combustion engines to drive its auxiliary service, at heavy cost, appears an absurd situation. We admit that past experience with the battery omnibus has not been of an encouraging nature; but that is no reason why the vehicle should remain for ever under a ban. The commercial electric vehicle has undoubtedly made good; so will the electric omnibus, when it is taken in hand by a competent authority.

But little reference was made to railless electric traction at the Conference, and this was to be regretted: the trolley-'bus has done good service in many districts, and possesses advantages which entitle it to consideration as a practical alternative to the self-propelled omnibus. Indeed, one speaker suggested that it might yet prove a rival to the tramcar, its working expenses being at present 25 per cent. less than those of the car.

Scarcity of Coal in Berlin.

An exceedingly critical time for German industries is expected to arise in the course of the next two months in consequence of the comparative scarcity of coal. In the engineering trades in Greater Berlin the reduction in the stocks of coal and the inadequate deliveries of fresh coal have already prejudicially affected the operation of the works. At the beginning of this month the managers of the Siemens-Schuckert Works began to ration the works at Siemenstadt, this meaning the allotment of a certain number of hours of work per week to each shop or collection of shops. Thus some of the shops were in operation the first three days of the week, while in others the men were at work during the last three days, on eight-hour shifts. The near future will decide whether most of the shops are, or are not, to be brought to a standstill. In the case of the A.E.G., it is stated that one or other of the works will have to be stopped sooner or later; and the conditions at the cable factory at Oberschonweide have become very serious. The Bergmann Electricity Works Co. has not yet found it necessary to shut down any departments. The prospects in connection with the municipal electricity supply works are so unfavourable that extraordinary measures have had to be taken in regard to the supply of energy. Among others affected by the position of affairs are mentioned the Schwartz-Kopff Engineering Co. and Ludwig Loewe & Co. The situation in Vienna is even worse than in Berlin.

Better Late than Never.

Shortly after the outbreak of the war we drew attention to the fact that the German Transmarine Electricity Co., of Berlin, had a share holding of £650,000 in the Chilean Electric Tramway and Light Co., and suggested that the matter should receive the consideration of the Board of Trade. After the lapse of a very long period, the Board of Trade took official cognisance of the fact, and on April 27th, 1918, made an order vesting the shares in question in the Public Trustee as custodian under the Trading with the Enemy Act, 1916. These circumstances are recalled by the announcement made recently that the Public Trustee was prepared to receive tenders for the purchase of the shares in amounts of not less than 50 shares, although the name of the German company concerned was not mentioned in the advertisement.

THE PRINCIPLE OF RELATIVITY SIMPLY EXPLAINED.

By R. W. WESTERN.

The theory of relativity, the development of which has thrown so much interesting light upon the constitution of matter, and upon the nature of both electricity and magnetism, has attracted attention from all scientific inquirers, and particularly from the engineer, because it proves that the mechanical laws he is accustomed to apply, though accurate enough for his purposes, are not exact, being in fact approximations only to the laws which actually govern the behaviour of physical agents. It has, therefore, seemed desirable to set out clearly the principle on which the theory rests, and to deduce the more important consequences that immediately follow without entering into the transformation of co-ordinates, and the more abstruse mathematical developments in which time comes at last to be treated as a fourth dimension interchangeable with the others.

It is a deduction from the theory of a luminiferous ether that the velocity of light in free space is constant in all directions and independent of the motion of its source, and it is one which has always been accepted and acted upon by astronomers, whose observations are concerned with light from all parts of the visible universe. It is supposed that light must be propagated in an ether which is stagnant, in the sense that it is not subject to displacement by the passage of material objects through it. On this supposition it ought to be possible by measuring the velocity of light to ascertain at what speed we are passing through this unaffected ether. All the many experiments devised to this end, however, have given a null result, thus indicating that the constancy of the velocity of light is independent also of the velocity of the observer, and so furnishing a principle from which the theory of relativity has been developed by the combined labours of most of the eminent mathematicians and physicists of late years.

In explaining this principle, the employment of algebra will be avoided as much as possible, to facilitate perusal by those who have lost touch with mathematical symbols;

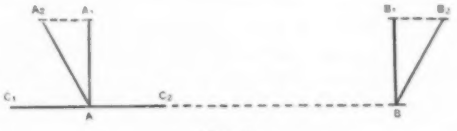


Fig. 1.

where its use is unavoidable it will be introduced with detail, and the subsequent steps fully set out. The limitation thus imposed, while it must exclude many applications of the principle, admits nevertheless sufficient for the purpose of illustrating it.

According to the theory of relativity all physical measurements are valid only for those who make them, and those similarly situated, and are at variance with measurements of the same phenomena made by persons differently situated. The character of this variance is illustrated very simply by disagreements as to the order in which events occur.

Suppose A and B, fig. 1, are moving apart, being separated with uniform velocity v, and suppose A to place the clocks C_1 and C_2 at equal distances on either side of the point A, in line with A B, and that he proceed to synchronise them. This he will naturally do by dividing a ray of light into two flashes directed one to each clock. B, of course, will expect to read an earlier time on clock C_2 than on clock C_1, because light from the latter takes longer to reach him, having further to go. The real ground for disagreement between them remains, after making due allowance for this correction. The ground of difference is this: To B, it seems, the synchronising flash reaches C_2 first (because C_2 is approaching the point from which it started), and that the synchronising flash is longer in reaching C_1 (because C_1 is retreating before it). Hence, if the synchronised clocks both record 12 o'clock, it will seem to B that the clock C_2 ought to be recording, say, 2 minutes to 12, and the clock C_1 3 minutes after 12. So that, while A thinks the tick made by the clock C_2 when it records 11.59, occurs before the tick made by clock C_1 when it records 12.1, B thinks the reverse. If B synchronised clocks in the same way, A must come to the same conclusion regarding them. The disagreement is irreconcilable, because it depends upon v the rate at which A and B are moving apart. If, for example, A were to set his clocks right according to B, they would be wrong for all other observers unless they, too, were separating from A with the same velocity v. The amount of disagreement depends not only upon v, but also on the distance between the two clocks. If A placed his clocks together he could synchronise them to the satisfaction of all. The conclusion must be that complete agreement as to the order of events is impossible unless they occur at the same place. It is important to see exactly why this is so, because the disagreement concerning physical measurement, which we shall come to later, rests on the same grounds. Had A synchronised his clocks by discharging shots simultaneously from the point A, no disagreement would have arisen, because the shots would have, superposed on the velocity imparted to them, the velocity of the gun which imparted it; and that being the velocity ascribed to A, B would have no reason for thinking that either reached its clock earlier than the other. This does not mean that A would have effected a true synchronisation, but only that B's suspicions would not be aroused. The disagreement is, in fact, revealed because the velocity of light, unlike that of material objects, such as shot, is not affected by the velocity of its source. Thus we see that simultaneity is universally valid only when confined to a single spot. If extended to separate spots, it has different meanings for persons having different relative speeds in line with the spots, and these differences are made apparent by the agency of light, because its speed, from whatever source, is independent of theirs. Simultaneity in separate spots is, therefore, strictly relative to persons similarly situated, and the theory of relativity being a theory by which it is shown that the same relative validity attaches to all physical measurements, rests primarily on this particular characteristic in the behaviour of light for its main principle.

This principle cannot be directly proved as a physical fact, but it has not been disproved by any experiments so far devised, and it furnishes a means of interpreting the behaviour of physical forces in a variety of situations, which it is difficult to interpret on any other hypothesis. Its credibility, therefore, is on the same plane as that of other principles which we employ continually without misgiving—the first law of motion, for example. We have seen that while A thinks that light moves with the same speed from A to C_1 and from A to C_2, B thinks it approaches C_2 faster than it approaches C_1. This is the essence of their disagreement. Every observer differently situated with regard to the motion of A and B must make a different estimation of the discrepancy, and there is no way of deciding between them. The principle, therefore, sets out that the velocity of light in free space is found to be the same in every direction by all observers; the result being unaffected by any uniform relative movement between the source of light and the observer who is engaged in measuring it. This is as much as to say that the units of time and space employed by the mind behind the observing eye undergo such changes as cause the velocity of light, as perceived, to be always the same.

Thus, suppose A and B, fig. 1, both measure the velocity of light in the direction A A_1 and B B_1 at right angles to the line joining them. The principle requires that they should both make it the same. Now suppose, as before, that A and B are moving apart, being separated with uniform velocity v. Each will then think that the other makes the velocity too great. To A it must seem that B's light ray takes the longer path B B_2, and B must think that A's light ray takes the longer path A A_2. Now it cannot be supposed

that A, in making his observation of the velocity of light, should take account of what B thinks, or anyone else ; he measures what he knows—the distance A A_1, and notes the time taken to traverse it ; of the distance A A_2 he knows nothing. B, seeing that A makes the velocity of light the same as himself, can only conclude that A measures the time occupied in too small units, crowding as many into the flight from A to A_1, as should go into a flight from A to A_2. A, of course, must come to the same conclusion with regard to B. It is easy to see in what ratio the units of time used by A and B stand one to the other in the estimation of each. If the time occupied by light in passing from A to A_1 is T_a in the estimation of A, and C is the velocity of light, the distance A A_1 will be C T_a, and the distance A_1 A_2 will be V T_a, so that the distance A A_2 will be $T_a \sqrt{C^2 - V^2}$, and T_b the time occupied by the light in the estimation of B will be $T_a \sqrt{(C^2-V^2)}/C$. Whence $T_b/T_a = \sqrt{(C^2 - V^2)}/C$, or $\sqrt{1 - V^2/C^2}$, usually written $\sqrt{1 - \beta^2}$.

Thus B finds A's unit of time shorter than his own, being in the ratio of $\sqrt{1 - \beta^2}$ to his, and in exactly the same way A finds B's unit shorter than his, being in the same ratio $\sqrt{1 - \beta^2}$ to the unit he uses himself. This is a necessary deduction from the principle set out.

There is no reason to think that A and B differ as to measurement of distances transverse to the line of motion between them, so we may take it for granted that this is the same for both, but as to distances parallel to that line of motion, differ they must. This follows at once from the reciprocal differences in their units of time. Suppose A to determine the velocity of light over the distance at which he has placed his clocks, and B to measure off an equal distance in line with A's, and to do the same ; both obtain the same velocity for light, and consequently each must impute to the unit of length employed by the other the same change that he imputes to his unit of time.

The disagreement as to the unit in which distances are measured can be confirmed by direct physical tests. The experiment named after its originators, A. A. Michelson and E. W. Morley, furnishes the best example. The description is as follows :—A beam of light from source S, fig. 2*a*, is directed upon a semi-reflecting mirror M, which is so set as to allow half the light to pass through to A, and to reflect half at right angles to B. The distances M A and M B are made equal by measurement, and mirrors are placed at A and B to reflect the light back to the semi-reflecting mirror at M, so that a moiety of the ray from A, and a moiety of the ray from B, both enter the telescope of an observer placed at T by whom their interference fringes may be seen and marked. Now, it is found that the position of the interference fringes is not altered however the apparatus as a whole may be turned about. This is the great fact established by the experiment of Michelson and Morley. If one of the two rays be longer upon its path than the other, as a consequence of turning the apparatus about, the fringes caused by their interference must necessarily be displaced. For an observer at the telescope there must consequently be equality between the two paths, and this holds good for all observers whose situation is that of the instrument. But for other observers differently situated, an inequality will appear, depending in amount on their velocity relative to the spot where the apparatus is, as we shall now proceed to show, and again we shall be driven to infer that, since they differ with each other and with the observers at the instrument upon the lengths of these paths, the units of length with which they measure them must be different.

The spot upon the earth's surface where the apparatus is has many relative motions. It revolves about its own axis and round the sun, and travels through the starry universe at a speed of many miles per second. Hence there can be no objection to supposing the apparatus so placed that it is moving from the point O in the direction S A, fig. 2*a*. Then in the time the A ray takes to pass from M to A, fig. 2*a*, the position of A will be A_1, fig. 2*c*, the position of M by then being M_1, and by the time the A ray has returned to M the position of the latter will be M_2 and that of A will be A_2. Again, when the B ray has reached B, fig. 2*a*, M will be at M_1, fig. 2*b*, and when the B ray has returned to M_1 the position of the latter will be M_2. Thus the path of each ray is lengthened when the apparatus is considered to be in motion by an amount depending on the velocity assigned to it. But both paths are not lengthened in the same proportion. That is to say, if M A remain equal to M B, the path traversed by the A ray becomes longer than the other, so that the absence of any displacement of the interference fringes to observers at the telescope, requires that M A and M B shall become unequal, the distance M A (the length of the arm in line with the direction of motion) being shortened. This is, perhaps, best seen in a numerical example. For convenience in arithmetic, we may suppose the apparatus moving from O in the direction O S A, fig. 2*a*, with a velocity which is 60 per cent. of that of light. Then if T be the time occupied by the B ray in traversing its whole path M B M_2, the length of this path will be C T where C is the velocity of light, and the distance M M_2 traversed by M will be 60 per cent. of that, or ·6 C T (fig. 2*b*).

So $\quad M B_1 = B_1 M_2 = \cdot 5\ C T,$

and $\quad M M_1 = M_1 M_2 = \cdot 3\ C T.$

M B the measured distance between the mirror B and the semi-reflecting mirror at M, which is transverse to the line of motion, we will call D_t. Now, M M_1 B_1, and M_2 M_1 B_1 being right angled triangles and equal to each other—

$$(\cdot 5\ C T)^2 = (\cdot 3\ C T)^2 + D_t^2,$$

or $\quad C^2T^2\ (\cdot 25 - \cdot 09) = D_t^2,$

whence $\quad \cdot 4\ C T = D_t$, and $T = 2 \cdot 5\ D_t/C.$

Again, in the time the A ray takes to pass from M to A, A will be at A_1, and M will have reached the position M_1, fig. 2*c*.

If T_1 be the time taken by the A ray in passing from M to A_1

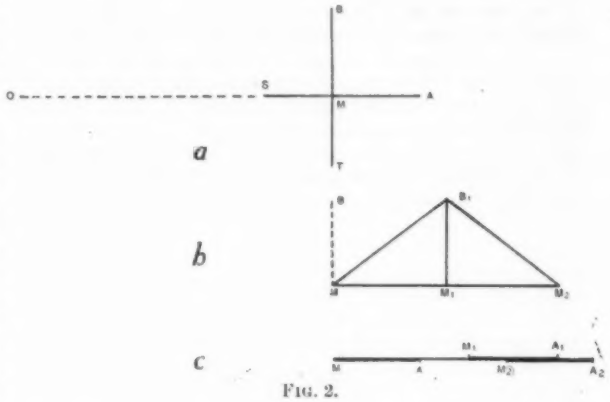


Fig. 2.

the distance traversed will be C T_1, made up of M A the distance between the mirror A and the semi-reflecting mirror at M (which being parallel to the line of motion we will call D_p), plus A A_1, the distance traversed by the apparatus in the time T_1 at 60 per cent. of the velocity of light, and, therefore, equal to ·6 C T_1—

i.e., $\quad C T_1 = D_p + \cdot 6\ C T_1,$

or $\quad C T_1 - \cdot 6\ C T_1 = D_p,$

whence $\quad \cdot 4\ C T_1 = D_p,$

and $\quad T_1 = 2 \cdot 5\ D_p/C.$

Thus, if M A remain equal to M B, *i.e.*, if D_p is equal to D_t, the A ray takes as long to reach the mirror at A as the B ray requires to traverse its whole path to B and back. This result is due to having assumed that the apparatus moves with 60 per cent. of the velocity of light. But that was done only for the sake of simplicity in arithmetic ; whatever rate of motion be ascribed to the apparatus, a discrepancy arises in the time taken by the two rays, because the paths they traverse are of different lengths.

In the example chosen the difference between the times taken by the two rays will be the time required by the A ray to return from A to M. In that interval of time M will have reached the position M_2, and A the position A_2 (fig. 2*c*).

If T_2 be the time taken by the ray in passing from A_1 to M_2 the distance traversed will be C T_2, made up of A_1 M_1, the distance between the mirror at A and the semi-reflecting mirror at M (which, again, is equal to D_t), less the distance traversed

by the apparatus in time T_2 at 60 per cent. of the velocity of light, which is, therefore, equal to $\cdot 6\ C\ T_2$,

$$\text{i.e.,} \quad C\,T_2 = D_p - \cdot 6\ C\,T_2,$$
$$\text{or} \quad C\,T_2 + \cdot 6\ C\,T_2 = D_p,$$
$$\text{whence} \quad 1 \cdot 6\ C\,T_2 = D_p,$$
$$\text{and} \quad T_2 = 0 \cdot 625\ D_p/C.$$

The experiment shows that the time taken by the two rays to traverse their respective paths from M and back to M is the same, so that in the example chosen we have—

$$2 \cdot 5\ D_t/C = 2 \cdot 5\ D_p/C + \cdot 625\ D_p/C,$$
$$\text{whence} \quad D_t = D_p\,(2\tfrac{1}{2} + \tfrac{5}{8})/2\tfrac{1}{2} = 5/4\ D_p$$
$$\text{and} \quad D_p/D_t = 4/5 = 0 \cdot 8.$$

Had we taken V to be the velocity of the apparatus, we should have had for the path of the B ray—

$$(\tfrac{1}{2}\,C\,T)^2 = (\tfrac{1}{2}\,V\,T)^2 + D_t^2,$$
$$\text{or} \quad \tfrac{1}{2}\,T\,\sqrt{C^2 - V^2} = D_t,$$
$$\text{whence} \quad T = 2\,D_t/\sqrt{C^2 - V^2}$$

and from the path of the A ray—

$$C\,T_1 = D_p + V\,T_1,$$
$$\text{or} \quad T_1\,(C - V) = D_p,$$
$$\text{whence} \quad T_1 = D_p/(C - V).$$
$$\text{Also} \quad C\,T_2 = D_p - V\,T_2,$$
$$\text{whence} \quad T_2 = D_p/(C + V),$$
$$\text{and since} \quad T = T_1 + T_2,$$
$$2\,D_t/\sqrt{C^2 - V^2} = D_p/(C - V) + D_p/(C + V)$$
$$= 2\,C\,D_p/(C^2 - V^2),$$
$$\text{whence} \quad D_p/D_t = \frac{C^2 - V^2}{C\sqrt{C^2 - V^2}}$$
$$= \sqrt{1 - V^2/C^2} = \sqrt{1 - \beta^2}.$$

(To be concluded.)

THE CULTIVATION OF FOREIGN MARKETS.

French and German Methods of Collecting Information.

The promotion of the export trade in manufactures and of the import trade in raw materials where home resources are inadequate to meet requirements, can only be facilitated by an increasing knowledge of the markets of the world, and most countries have now either made, or are completing, their arrangements for this purpose under the changed situation of international affairs. Apart from the improvements which have already taken place or are impending in the British Consular service, and in that incidental to the commercial attachés, the Americans have organised their foreign trade service in their own manner, and now the French and the German Governments are following the example.

The French Government, for instance, has just published the text of a law which aims at the reorganisation of the services of the Office National du Commerce Extérieur, the modification of the regulations concerning commercial attachés, and the appointment of commercial agents. Apparently the commercial agents are to be placed in charge of French commercial offices which already exist, or are to be created in other countries for the purpose of establishing business relations between French producers and foreign purchasers, and the promotion, as far as possible, and particularly by the exhibition of samples and patterns, of the sale of French merchandise and the development of French exchange with foreign countries. It is proposed to make a charge to merchants and manufacturers for the display of samples and patterns, and for various other services which may be rendered to them, and these fees will be subject to the approval of the commercial attachés concerned. At the same time, the commercial offices abroad will receive a Government subsidy, the amount of which will be fixed annually on the presentation of the Budget estimates.

The Office National du Commerce Extérieur is connected with the Ministry of Commerce, and has been appointed correspondent in France for all the commercial offices abroad; but neither will undertake commercial operations on its own account. The object of the Office National is to supply French manufacturers, whether by special reports or general publicity, with commercial information of all kinds capable of contributing towards the development of foreign trade, the extension of markets abroad and in French Colonies and Protectorates. Although not expressly mentioned, it is reasonable to assume that the commercial offices in other countries will be required to furnish the Office National with information for the preparation of the reports in question in so far as concerns the countries where they are to be established.

If we now turn to the German scheme, it is found that the Diplomatic and Consular services have been combined to some extent, and future officials will undergo both commercial and political training before being dispatched on their missions. As, however, considerable time will elapse before adequately trained officials will be available, the emergency has been met by the creation of a Foreign Trade Department at the German Foreign Office, which department is said to have been endowed with funds to render it financially independent, which is self-governing, and whose decisions, according to Prof. Wiedenfeld, the controller, the Foreign Office has no right to veto. The same confusion and delay which have prevailed in Great Britain in the past in the dissemination of information received from official representatives abroad, so that the information was frequently out of date and useless when it reached interested circles, have also existed in Germany, and probably for the same reason. The German controller, for instance, states that the lack of system was due for the most part to the circumstance that the information reached the hands of people who were neither specially educated for the purpose, nor were familiar with the economic conditions of their own country. Now, however, the new department forwards regular reports to the officials abroad dealing with German economic conditions, based on arrangements made with the big trade syndicates, corporations, &c., and the reports are accompanied by sheets of questions, and by individual inquiries made by syndicates and others interested. In this way assistance is rendered to the officials abroad in the preparation of their reports for the benefit of the home industries. Not only so—and this of particular importance—but a system of commercial reports has been arranged for with private interests in neutral countries, that is to say, in countries with which Germany has not been in a state of war. In other words, it is openly admitted that the system of commercial espionage which was practised in pre-war days, and also during the war, is now a part of the definite official programme. The information is to be distributed by the Foreign Trade Department without delay through the official journals for ordinary matter; by means of special reports in pamphlet form, and by the circulation of confidential information; and in the latter case the information will be dispatched by express delivery either on the date of receipt in Berlin or on the following day. A subscription has been introduced for the last-mentioned service at the rate of £5 per annum for each country or branch of industry, or £50 per annum for the entire service. As great importance is attached to having a close connection between practice and the Government officials, an Administrative Board for the Department is being formed of from 25 to 30 practical men and five or six representatives of Government Departments.

We have summarised briefly a part of the arrangements being made in France and Germany for the advancement of the export trade of the two countries, as it is advisable for us to be kept conversant, as far as possible, with the developments proceeding or projected outside of Great Britain. The very significant point about the German scheme is the creation, as is claimed, of a self-governing and financially independent Department by a country impoverished by years of warfare, and having enormous financial obligations to meet for many years forward. On the other hand, it is always a difficult matter to induce the British Treasury authorities to approve of the particular amount of expenditure which is so essential for the development of our services of foreign information on a scale commensurate with the needs of the Empire.

THE MUNICIPAL TRAMWAYS ASSOCIATION.

(INCORPORATED.)

(*Continued from page* 361.)

The eighteenth annual Conference of the Municipal Tramways Association (Incorporated) was held in Dundee on 17th, 18th, and 19th September. This was the third occasion since the inception of the Association that the Conference was held in Scotland, Glasgow having been the venue on the two previous occasions. The 1919 Conference will long be remembered, not only for the importance of the business transacted, and the success and harmony which marked the proceedings throughout, but for the hospitality extended to the members. Business and pleasure were judiciously blended, and the Conference was voted a complete success by all who took part in it. About 150 members attended the meeting, and the lady friends of the members numbered about 50. The home of the Conference for the three days was the Albert Institute, a magnificent pile of buildings in the centre of the city, in which are housed the Public Library, the Museum, and the Art Galleries. The Local Committee had made perfect arrangements, and the hospitality of the Corporation of Dundee was on a scale rarely excelled in the history of the Association.

The proceedings commenced on Wednesday at 10 a.m., when the Executive Council met, under the chairmanship of Mr. T. B. Goodyer, general manager of the Croydon Corporation tramways, and President of the Association. At 10.30 a.m. a civic reception was accorded to the members of the Association and their lady friends. When Lord Provost Sir William Don, K.B.E., accompanied by the magistrates and other municipal dignitaries, and headed by the halberdiers, all attired in their official robes, arrived in the conference hall, they were warmly cheered, and officially received by the President and Alderman Sir John W. Courtis, Cardiff, Vice-President of the Association.

The Lord Provost, on behalf of the Corporation and citizens of Dundee, welcomed the Association to the city, and said he hoped that not only would its deliberations result in benefit to the tramway world, but that the members would thoroughly enjoy themselves.

Mr. G. A. Johnston, convener of the Dundee Tramways Committee, associated himself with the remarks made by the Lord Provost, and the President and Vice-President returned thanks.

The first business on the agenda was the President's address, which was abstracted in our last issue.

Councillor Squires, J.P., chairman of the L.C.C. Highways Committee, moved a vote of thanks to the President for his very able address, which motion was seconded by Mr. Alderman Russell Taylor, J.P., London, and carried with enthusiasm.

The Conference then sat in private to hear a statement from Mr. McElroy on the position regarding the demands of the men. A telegram was read from Mr. Fearnley, Sheffield, stating that the employés there had decided to resume work on the old terms, and the announcement was loudly cheered.

When the Conference resumed in public, Mr. Peter Fisher, manager of the Dundee Corporation Tramways, read a paper giving an historical sketch of Dundee.

On the motion of Councillor R. Mayne, Newcastle, seconded by Alderman Brown, Leeds, Mr. Fisher was cordially thanked for his paper.

Councillor Kelly, convener of the Glasgow Corporation Tramways Committee, then read a paper entitled "Where do we Stand?" of which an abstract follows, and the discussion occupied the rest of the morning and afternoon sittings.

In the evening the members and their lady friends were entertained at dinner by the Corporation of Dundee. Lord Provost Sir William Don presided, and there was a large attendance of members and representative citizens. A feature of the dinner was the bringing in of the Scottish haggis in true national style. The dish was carried on a large salver by two men, preceded by a couple of pipers in Highland dress.

Before commencing the proceedings proper on Thursday morning, the Conference resolved itself into a Managers' Committee, when it was unanimously decided that the managers' meetings, which were suspended during the war, should be resumed next year. The President pointed out that many important matters affecting managers were coming up in the near future. It was left in the hands of the Executive Committee to fix the date and place of the first meeting.

Mr. A. R. Fearnley, Sheffield, then opened the general proceedings by delivering an address on "Motor-Omnibus Services," which was followed by a discussion.

In the afternoon the business meeting of the Association was held, when the annual report of the Executive Committee and the accounts were adopted.

Sir Jno. W. Courtis was unanimously elected President for the ensuing year, and Mr. G. W. Holford (Salford), Vice-President. The following were elected to the Executive Committee:—Alderman Wyllie, South Shields (for three years), and Councillor Higham, Blackburn (one year). Managers:—Messrs. J. Dalrymple, Glasgow; P. Fisher, Dundee; and J. Barnard, Bolton—all for three years—and Mr. R. L. Horsfield, Walsall (for two years).

The proceedings concluded with votes of thanks to President Goodyer and the Executive Council, and to the Corporation of Dundee for the hospitality extended towards the delegates.

On Friday the delegates and their lady friends were entertained by the Dundee Corporation on a river excursion to Kinfauns.

Where do We Stand?

By Councillor Kelly. (*Abstract.*)

During the past five years the tramway industry has been carried on under great difficulties. All our ingenuity and our energy have been expended in keeping the car wheels revolving. There have been very few extensions made in any direction, and the introduction of new and improved methods has had to be altogether neglected. I am constrained, therefore, at this time to ask the question—and to induce every tramway man present to ask the question—where do we stand? It is up to us not only to ask this question, but also to answer it, and to make whatever plans may be necessary to ensure that our tramway systems are placed on a thoroughly sound footing, and are carried on in the most efficient way.

Where Do We Stand Politically?

It is now absolutely necessary that we should come to some definite understanding as to what is to be our policy in regard to the tramcar. Some of us have already statutory powers for considerable extensions throughout the districts surrounding our various urban communities. We are now faced with the problem of the motor 'bus on the one hand, and the enormous cost of laying new lines on the other. There is no doubt that we must provide better travelling facilities than we are giving to-day. In some places, perhaps more in Scotland than in England, our people are going to be more spread out than they have been hitherto, and these people must have the best and cheapest transit that it is possible to give them to and from the centre. What means of transit can cope with this traffic in the most efficient way?

If it is decided that the tramcar holds the field, and that the new conditions which will arise through the spreading of the population must be met by an extension of the tramway systems throughout the country, we will be faced with a huge amount of work.

We will require to consider, in order to give rapid transit, whether we could not make more tramways along their own right-of-way. We will also require to consider whether there could not, with advantage, be more amalgamation of tramway concerns. There are at present too many tramway authorities. The idea that a tramway car must turn at some imaginary boundary line is surely very absurd. I believe we have in the electric tramway an instrument which is far ahead of any other for spreading the population.

Where Do We Stand Mechanically?

I want to know whether we are thoroughly up-to-date in our plant, chiefly in our rolling stock. Have our managers selected the best type of car for each set of conditions? The car which is best for one tramway undertaking might not suit another. Have our managers studied every phase of this

question? Are they all satisfied that they have the best equipment for the conditions under which they have to work? Have they visited other concerns and studied the methods adopted for selecting and maintaining the equipment, or is each manager satisfied that he has nothing to learn? I hope not. During the past five years all tramway concerns have had great difficulty in obtaining material, and this difficulty still continues. In many places the track is in a dreadful condition, and some committees have been severely dealt with for placing contracts for rails abroad, although the only alternative was to allow the track to go to ruin. Whatever happens we must maintain our track and equipment. Some concerns have been unable to do this, and there comes a point in the depreciation of plant when maintenance is impossible.

Where Do We Stand Electrically?

Great changes are shortly to be introduced into the electrical world, but we are yet very much in the dark as to what effect these changes will have, either on those tramway undertakings which purchase their energy, or on those which generate their own. Our great concern just now is the supply of coal. We know that the price is bound to go up whatever happens. What we do not know is whether we are going to get throughout this winter a sufficient quantity of coal to meet our requirements. In 1901 we purchased better coal at 6s. 9d. per ton than we are getting to-day at 29s.

Where Do We Stand Economically?

During the past few years great changes have taken place both on the revenue and on the expenditure side of our tramway account.

The revenue of a tramway undertaking consists almost solely of passenger fares, and there are now only one or two tramways in the country on which the fares have not during the past three years been increased. Only a very few have been able, however, to increase the statutory maximum. These increases have almost invariably resulted in a largely-increased revenue. This means, of course, that passengers are prepared to pay any reasonable increase. It looks now as if fares are going to be permanently higher.

The bulk of the expenditure of a tramway undertaking consists of wages, and this item has gone up since 1914 over 100 per cent., and still further demands are being sent in for further concessions, both in hours and wages.

For some years back we really cannot be said to have been managing our own concerns. We have simply had to pay wages which have been fixed for us, and have had to pay prices for material which we were powerless to question.

The question of capital expenditure is now more serious than it has ever been before. Both municipalities and companies will require to expend large sums on extensions and for increased plant and equipment in the near future. Will we be able to borrow the necessary capital?

We must also look carefully into the provision we have made to meet depreciation and the cost of renewals. The provision we made prior to the war, if then just sufficient, must now be increased by at least 100 per cent.

I am against a municipality running a tramway in order to make a profit to be handed over in relief of rates, and I am also against a tramway becoming a burden on the rates. The fares charged should yield sufficient revenue to meet operating expenses, maintain the undertaking, and meet all fixed charges. Many of our municipal systems are too small and circumscribed. In many instances all that is wanted to ensure financial success is a linking-up.

Where Do We Stand Traffically?

I may have coined a new word here, but I have no doubt that the meaning is plain.

The question of traffic is coming very much to the front at present, and if the population of our towns and cities grows steadily for the next few years, we must tackle the whole question, not only from the point of view of the tramway traffic, but of all classes of traffic.

My own view is that if the city traffic generally were scientifically regulated, we could use the surface of our streets to much better advantage than we do at present. In most towns and cities the great bulk of the streets are quiet, even deserted, while the few streets are congested beyond measure.

As the population increases and spreads itself over a wider area, our difficulties will increase as the great trek is always to and from the centre. The lay-out of some of our older cities does not lend itself to the formation of alternative routes, and at the present time the whole traffic is being carried on one main artery. This is not as it should be, and steps must be taken immediately to relieve these main arteries by opening up new ones.

People not only want a cheap and frequent service, but they want a rapid service, and this can only be given by a thorough system of traffic regulation.

We have heard a great deal about queues; the great drawback is that where this system might be of some service, it is quite impossible to adopt it.

Some cities have a by-law under which slow traffic must keep as near the kerb as possible. This has been found of great service to all fast traffic. Some cities also have a by-law which prohibits any kind of traffic passing between a tramcar and the kerb at a stopping place when passengers are entering or leaving. This by-law is also of great service when drivers know that it is strictly enforced. Unless the tramway people take up the question, nothing whatever will be done.

The municipalities of this country employ many thousands of men and women. They operate hundreds of miles of single track and have expended millions in capital. The income and expenditure were never greater than they are to-day, and the number of passengers is mounting up year by year. We must, therefore, take such steps as may be necessary to ascertain where we stand in all sections of our work, and this is most assuredly the proper time to make a move in this direction.

I trust that the municipalities will see that it is to their advantage to offer inducements to our best men to enter the tramway world. Tramway men should get facilities for studying what is being done on the various tramway systems, not only in this but in other countries. In no other way can they so cheaply and so effectively keep abreast of the times.

Discussion.

Councillor J. W. Squires (London County Council) opened the discussion. Speaking for London, he said frankly that the question "How do we stand politically?" was one he was unable to answer. The problems of the London traffic had been a subject of exhaustive examination by two Select Committees of Parliament and one Royal Commission within recent years, but so far no practical step had been taken to unravel the traffic problem of the Empire's capital. The operation of the tramways in the centre of legislation and political activity brought into play forces of partisanship and controversy which had no counterpart elsewhere. In London they were handicapped at every point by the fact that they were not masters in their own house. On the question of tramways or motor omnibuses, he said the needs of the travelling public and the best manner to meet those needs fully and economically were, in his view, the only consideration that should be allowed to weigh.

In answering the question "How do we stand economically?" Councillor Kelly had said that our tramways should pay their way. In his (Councillor Squires') opinion that view was the only sound and possible one to take. He asked for absolutely sound finance, and contended that they were entitled to the support of the Government in their fight for sane financial methods.

Councillor Jackson (Liverpool) said that in the many countries that he had visited he had found progress which we did not yet seem to have been awakened to. He appealed to municipalities to give opportunities to their managers, deputy managers and engineers to visit the whole world if necessary. They would bring home practical ideas regarding transportation which we would never forget. In the collection of fares they lost thousands of pounds a year. They had to get money to pay better salaries. He would like to see general managers of ability paid from £2,000 to £4,000.

Mr. Alderman F. Smith (Liverpool) said they must have good men and pay them well. He agreed that they ought to send officials out to make observations. He was against the municipalities running tramways in order to make profit. Mr. Kelly meant to say that the tramways ought not to contribute to the rates, and there he heartily disagreed with him.

Councillor Turner (Belfast) said that the salaries paid by some of the undertakings were inadequate to the services rendered. It was a moot question if they had been "standing" during the war; they had been swept along by the Labour Party. While they must treat the men well they must really take a stand somewhere.

Alderman Fenton (Sheffield) objected to the Glasgow Corporation going to America for rails even though they might have had to pay a bit more for them at home. Greater powers should be given to the larger Corporations for local legislation with regard to their concerns. They were paying far too much money in going to Parliament for small extensions and amalgamations or anything of that sort instead of being able to settle these things themselves. Great economy would be got by local authorities linking up and concentrating the management. To that they must look for cheaper transport not only for passengers but also for goods.

Councillor Irvine, M.P. (Birmingham), said the ideal principle that a tramway system ought to be worked upon was that they should seek no profit in the monetary sense but profit in the real sense—the comfort, convenience and pleasure of the citizens. In no sense should a tramway system be urged to spend profits for the reduction of rates, which were levied for the purpose of conveying to the citizens advantages which were certainly equivalent to the rates levied.

Councillor Collins (Nottingham) said that they had a right to make a profit for the simple reason that there was a section of the community who contributed not a cent to any municipal work. Although his committee was composed of Labour members, they felt that they had come to the parting of the ways in regard to payment. They did think that a stand should be made. They could do with a strike for a time. They would get a large section of the public favouring their views.

Mr. Murray (Walthamstow) said the difficulties which met them were accentuated by the fact that there was such a vast difference between the various tramway undertakings represented there. Those who had narrow streets and single tracks were confronted with an enormous expenditure, and some of them could not face it under present conditions. In

some things they had lost their opportunity. They ought to have resented to the very last a national agreement as to conditions of service and wages. That was the huge mistake they made in the past. The conditions that regulated in a small provincial town were not compatible with those in Glasgow, London, and Manchester. They should take a firm stand, and things ought to be settled in districts. Unfortunately in the economical sense they did not stand at all. Some of them were tottering and some had already fallen, and some he feared in the near future might be in the position of insolvency.

Mr. Wail (Coventry) supported the amalgamation of small undertakings with large municipal undertakings. He disagreed that they should tax the flapper and so on. They had to make their concerns solvent without any application to the rates.

Councillor West (Walthamstow) thought that they should attempt to give the best means of transport possible for the whole of the country and leave the individual section to work out its best means.

Councillor Fryer (Birmingham) said that indirect taxation was unsound, because they were taxing one section of the community for the benefit of the other. He pointed out that the profits rnised were subject to income tax of 6s. or 7s. in the £, and that called upon many people to pay income tax who were not liable for so doing. In his opinion the whole savings of undertakings, after the managerial and operative sides were well paid, should be reflected upon added benefits to the users.

Mr. Beckett (secretary) pointed out that there was a delusion involved in the previous speaker's remarks about income tax. For example, where the profits of a tramway undertaking assessed under Schedule D were less and not more than the interest paid out of the rating fund to which the tramways were by statute attached, the tramway profits escaped taxation for the reason that to the extent of such taxed profits they were set off against the interest paid out of the rating fund.

Councillor Kelly, in replying on the discussion, pointed out that Glasgow had no alternative but to buy the rails from America, as the English firms could not supply them. In 25 years under the heading Sinking Fund Reduction Revenue Account they amassed in Glasgow a sum which wiped off their tramway debt. Yet they always had low fares. A small proportion of the members of the Corporation would vote for profits being applied for the reduction of rates. They had now a surplus of four millions, and that was part of the assets of the common good. It was the halfpenny fare which was the trouble in Glasgow. They simply loved halfpenny fares, but he might say that they were on the bedrock, and his expectation was that their general manager was going to show that in the first three months of the present year they were not meeting their working expenses.

(To be continued.)

NATIONAL HEALTH INSURANCE ACT, 1919.

By JOS. J. H. STANSFIELD, F.C.I.S.

The National Insurance Act, passed in 1911, provided for insurance in respect of health and unemployment. The provisions against unemployment applied only to a limited number of workmen, but in September, 1916, the Board of Trade extended the application of this section of the Act to munition workers.

An alteration has now been made to the section of the Act relating to health insurance by the passing of the National Health Insurance Act, 1919, thereby including certain employés engaged otherwise than by way of manual labour who were previously exempt.

Under the original Act, with certain minor exemptions, all persons employed by way of manual labour were insurable irrespective of the amount of their earnings, but under Section (g) of Part II of the First Schedule to the Act it was provided that insurance was not payable in respect of employment otherwise than by way of manual labour where the rate of remuneration exceeded a value of £160 a year or in cases where such employment involved part-time service only at a rate of remuneration which in the opinion of the Insurance Commissioners was equivalent to a rate of remuneration exceeding £160 a year for whole-time service.

By Section 1 (1) of the Act just passed £250 has been substituted for £160, and many employés will now be insurable who previously escaped liability.

It was, however, provided by Section 2 of the Act of 1911 that where any person employed within the part of the Act referring to health insurance proved that he was either (*a*) in receipt of any pension or income of the annual value of £26 or upwards not dependent upon his personal exertions or (*b*) ordinarily and mainly dependent for his livelihood upon some other person, he was entitled to a certificate exempting him from the liability to become or to continue to be insured under the Act.

This section is applied to an employé who now becomes insurable, provided that he satisfies the Minister of Health on an application made before January 1st, 1920, or such later date as the Minister may in any particular case allow, that he is engaged in employment which, but for the provisions of the new Act, would have been excepted by the original Act of 1911, and that he has not since August 15th, 1919, been engaged in any employment which would not have entitled him to a certificate of exemption, but provided further that if he subsequently enters into any employment in which he would not be entitled to exemption the certificate would cease to have effect. With respect to exemption, it should, however, be pointed out that the obtaining of a certificate will not exempt the employer from making the usual contribution in respect of the employé.

The Act is deemed to have come into operation on June 30th, 1919, but no liability is imposed in respect of the payment of contributions payable between that date and August 15th, 1919, and both employers and employés are therefore only liable to pay health insurance from and including the week ending August 16th, 1919.

The passing of the Act will require employés who are now insurable to become members of a society which has been approved, or to become deposit contributors, when, in the latter case, all contributions paid by or in respect of such contributors will be credited to a special fund at the Post Office. The object of the Act of 1911 is, however, that as many persons as possible should become members of approved societies, there being no reserve value in the case of deposit contributors, and as deposit insurance only offers a limited protection, there is a strong inducement to become members of an approved society.

Non-manual workers who are now insurable should, therefore, without delay apply to an approved society so as to obtain insurance cards to hand to their employers.

There will be a certain number of employés who will now be included who were at first insurable under the Act, and who subsequently became uninsurable because their remuneration exceeded £160 per annum. Unless their cards have continued to be stamped it will be necessary to do this if they wish to preserve continuity of the insurance and secure full and immediate benefit. If this is not done they will not be in full benefit until after 104 weeks in insurance have passed, and 104 weekly contributions have been paid.

In the case of those who have continued as voluntary contributors but who are in remunerated employment, and whose salary is not over £250 a year, they can now resume as ordinary employed contributors in accordance with Section 6 of the principal Act, but they must obtain an employed contributor's card, which may be stamped at the full rate as from July 1st, 1919, which will at once bring them into full benefit.

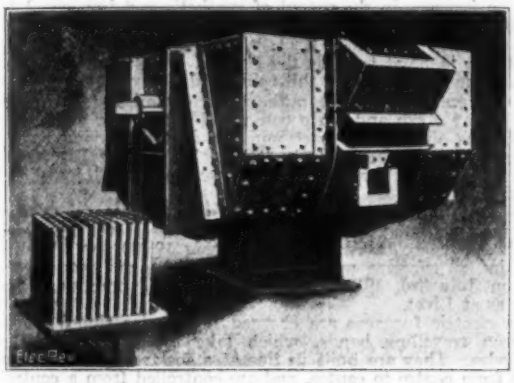
Summer Time in France.—The change from summer to solar time will probably be made in France during the night of October 4th-5th. The President of the Chamber of Commerce, M. Pascalis, advocates retaining summer time throughout the year. The application of the eight-hour day, he says, by causing an hour's delay in starting work, means a considerable reduction in the number of people who rise before daybreak, and retention would save coal.

SYNTHETIC CAST IRON.

By CHARLES ALBERT KELLER (Livet, France).

(Abstract of paper read at the Autumn Meeting of the Iron and Steel Institute.)

The novelty of the manufacture of "synthetic cast iron" consists in carburising iron and steel scrap, and more particularly turnings, by melting these materials in the presence of carbon. The electric furnace is plainly indicated as best fulfilling all the conditions required for the carrying out of this operation. Only a process of continuous carburisation, effected during the course of melting a mixture of steel turnings and carbon, could conduce to an economic method of producing synthetic cast iron with a commercial future capable of development as other than a mere war emergency.



Tilting Type of Keller Furnace, with Conducting Hearth.

In an electric furnace charged with steel turnings mixed with carbon the carburisation is not only absolutely controlled by the known reactions of the substances present, but the combination of the carbon with the iron begins in the upper parts of the charge, long before actual fusion. Cementation intervenes from a temperature of 650 deg. upwards and becomes more rapid in proportion as the temperature rises, owing to the descent of the charge. Carburisation of the iron takes place subsequently, by the contact between the solid carbon and the partially carburised metal in the course of melting, and becomes complete on full melting, the temperature of which is determined by the nature of the iron, so that casts can readily be obtained in the electric furnace at temperatures of 1,200 deg. to 1,300 deg. C.

The mixture of steel turnings and carbon possessing very high conductivity, it would become necessary, to ensure normal working in the electric furnace, to use so low a potential that higher currents than those ordinarily in use could be employed. On the other hand, it would be a pity to employ electric fusion without profiting by the metallurgical advantages involved, in order to effect desulphurisation. The introduction of basic slag into the charge meets these two requirements and accomplishes two results, subsidiary and supplementary to the carburisation and necessary to the complete practical success of the process, namely,:—

(1) The lowering of the conductivity of the mass to be treated by the introduction of a non-conducting material amongst the conductive materials (turnings and carbon), thus enabling fusion to take place under ordinary thermo-electric conditions, and

(2) Complete and easy desulphurisation of the resulting metal.

Thus carried out, the process may be described, from the metallurgical point of view, in the following terms:—

The iron obtained in the presence of a sufficiently basic slag, which combines with the small amount of silica introduced, will contain practically all the substances contained in the charge, except the sulphur. There will be no increase in the silicon, and the carbon in the charge will be used up solely in carburisation, without any appreciable intervention of the silica.

White cast iron can thus easily be obtained with ordinary steel turnings. With turnings containing 0.44 per cent. of silicon, 0.55 per cent. of manganese, and 0.07 per cent. of sulphur a white iron of the following composition was obtained:—

	Per cent.
Carbon	3.55
Silicon	0.52
Manganese	0.48
Sulphur	traces

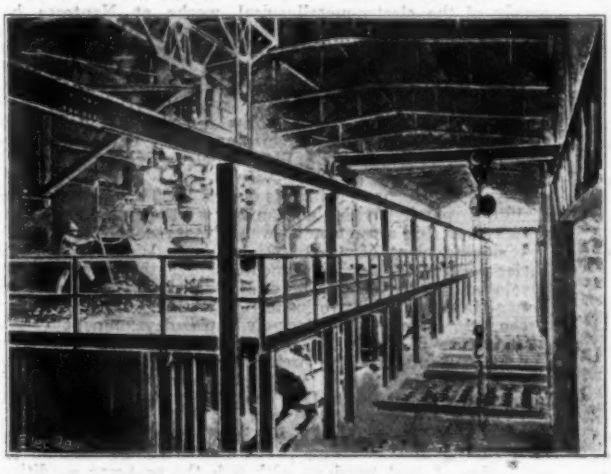
Hence control of the percentages of silicon and of other elements becomes easy.

An electric furnace with a capacity of 80 to 100 tons per 24 hours has not given rise, over a month's working and while specially watched for that purpose, to variations exceeding 0.25 in the results of carburisation and of siliconisation respectively.

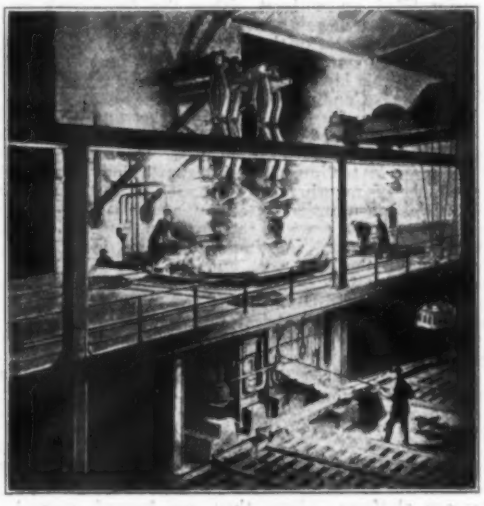
The system is one of extreme simplicity. It does not require any skilled workman, as the results sought are independent of any technical manipulation except in so far as the preparation of the charge is concerned, and depend entirely on an accurate knowledge of the composition of all the components.

The electric furnace, fed continuously by the charge, works regularly and with very small losses, as the heat transmitted by the electric hearth situated immediately beneath the charge is, to a very large extent, utilised in heating up the materials, and effects a preliminary carburisation prior to melting. This enables the consumption of electrical energy to be reduced to as little as 675 kw.-hours per ton of pig in a 2,500-kw. furnace of 80 to 100 tons. Maintenance of a furnace, working in the manner described, is barely appreciable; with a six months' campaign at Livet the above furnace did not require any repairs either to linings, shell, or any other part. The lining only needed some attention when the furnace was put out of action owing to the water-power supply failing.

The electrode consumption can be lowered to as little as 6 kilogrammes per ton, with electrodes of good quality. The consumption of unoxidised turnings is 1,050 kilogrammes per ton of iron. The amount of coke with 80 per cent. fixed carbon required to produce a ton of strong pig iron with 3 per cent. of carbon and 1.75 per cent. of silicon, starting with normal turnings of shell steel, is about 80 kilogrammes.



Keller 2,000-kw. Furnaces at the Livet Works.



Keller 2,500-kw., 80 to 100-ton Furnace.

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A furnace of the 80 to 100-ton type should be provided with mechanical appliances for upkeep and charging, so that its operation does not require more than 15 workmen, for the preparation, by hand, of the charge, for charging, and for regulating the furnace. Tapping and loading-up on trucks as required needs seven men per unit, and handling in the stockyard another two men.

The foundry iron from the primary furnace may be made use of by transferring it to an electric mixer, which can mix several casts and thus keep any quantity of metal ready for castings. This mixer, of the steel furnace type, allows of the quality being ascertained by samples being taken before casting.

The manufacture of malleable cast iron is likewise easily accomplished in the electric furnace, as the general quality of the steel turnings enables the low percentage of silicon and manganese required to be readily obtained, the reduced percentage of carbon present being dependent on the composition of the charge.

After the war steel turnings will come from a variety of sources, and very often it will be their dephosphorisation which will be of chief importance when a cast iron of high quality is required. The author has practically accomplished this by means of a dual process.

About 1,500 KW.-hours must be allowed for the two operations. The higher costs of manufacture are balanced by the higher value conferred on the synthetic cast iron by reason of its extreme purity in regard to phosphorus, and likewise its purity from sulphur and its uniform composition in respect of silicon and manganese. From the commercial point of view such material can compete with Swedish iron.

The author believes that readers will share his conviction that the method of obtaining electrical iron by the synthetic process is destined to continue to play a useful part in metallurgy. The production of synthetic cast iron during the war at Livet, Nanterre, and Limoges alone exceeded 150,000 tons.

The first electric furnace, of 20 tons, was started in 1914. The uniformity of the iron and the tensile qualities obtained led to its being immediately considered from the standpoint of shell manufacture, and the production of 220-millimetre shells of synthetic semi-steel was undertaken at Livet on a commercial scale from the commencement of 1915. The iron obtained in three primary furnaces is run into a ladle of 5 tons and poured into three 7-ton electric mixer furnaces, each taking 400 KW., to reheat the metal if necessary and to keep it hot. The mixer-container furnaces for steel are of the Ch. A. Keller type, that is to say, they have a roof and doors. The electric current enters by a vertical electrode, and leaves through the conducting hearth, of the reinforced-puddle type (vertical bars plunged into tamped magnesite). A conducting hearth of this description is practically unwearable, being non-susceptible to any cracking. If the bottom conducting surface of the hearth wears gradually lower, repairs are very easily effected by spreading over the bottom, while still hot, a special conducting puddle consisting of magnesite and fragments of iron mixed in tar. All holes are thus easily filled up without either the framework or the working of the hearth being interfered with in any way. The furnaces are, of course, of the tilting type.

The liquid iron poured in is covered with basic slag, which forms a protecting layer, preventing oxidation and breaking the electric arc. Generally speaking, the metal remains an hour in the mixer furnace, including the time of pouring. The practice described gives complete satisfaction, and ensures uniform metallurgical results. The upkeep of the mixer furnaces is trifling. The interior lining of the mixer lasts a couple of months, and the roof over three months. The electrode consumption is on an average 2 kilogrammes per ton of iron: the average consumption is from 50 to 100 kilowatt-hours per ton. A single workman is required for the working of the furnaces, and he also looks after the tapping, the electrical manipulation of the tilting arrangements, and the taking of samples.

The capacity of the electrical foundry at Livet could not keep pace with the output of casting metal, which began at 20 tons per day, was subsequently increased to 60 tons, and later on reached not less than 300 tons during the period of maximum water-power supply.

A new special works was laid down near the original works, and started on July 12th, 1916, with a furnace of 80 to 100 tons. The turnings were handled by means of a powerful electromagnet suspended from a high-speed crane. The charges are mechanically raised by large bucket elevators to the furnace platform, where they are heaped around the electrodes. The transformers are housed in sheds built on reinforced concrete foundations on the level of the platform of the electric furnaces.

There are five Ch. A. Keller furnaces of the "electrodes in series" type arranged in line, four being of 2,000 KW. and one of 2,500 KW. The output of this installation is 300 tons of synthetic iron per day.

Loading the iron on wagons is effected by means of an electromagnet suspended from an overhead electric crane, which serves a line of railway parallel with the front of the electric furnaces. By this means a 10-ton wagon can be loaded up in fifteen minutes.

The lay-out of this works provides for a complete unit of manufacture, in transverse section, for each pair of furnaces, this arrangement being repeated along the whole length, and thus securing the best possible arrangement for the supply of raw materials, and for the removal of the manufactured products, each unit having lines of railway along its sides and being thus connected up with both ends of the works. The haulage of the wagons is effected by electrical capstans. A shop has been laid down to house electrical converter furnaces to serve a steel foundry. The special synthetic iron employed for this conversion is poured into a ladle on the side of the furnace furthest away from the pig beds. The ladle can thus be conveyed along a longitudinal pit by an electric overhead crane, so that its contents can be poured into the converting furnaces. This arrangement for casting from both the opposite sides of the electric furnace enables the material to be cast, very conveniently, either into pigs or poured into the ladles.

The rapid extension of the use of synthetic cast iron led the Keller Leleux Co. not only to lay down new works for its manufacture, but also to develop fresh waterfall supplies in order to increase the power resources at the Livet Works.

The Vernes Fall (7,000 H.P.) hydro-electric works on the Romanche was put into operation in July, 1918. The additional power thus developed at the Livet Works corresponds with an increase in the output of synthetic cast iron equal to 25,000 tons per annum.

The Bâton Fall (7,000 H.P.), which is 1,100 metres high, was taken in hand towards the close of 1917, and the hydro-electrical machinery is on the point of delivery.

At the end of 1916 the author was commissioned by the State to lay down and equip works at Nanterre for an output of 300 tons of synthetic cast iron per day, employing power derived from the sector of the "Société d'Energie Electrique de la Region Parisienne," whose power-house had just been completed.

The electro-metallurgical works, which is known as the National Gun Foundry of Nanterre, comprises seven furnaces, of which six are in operation, requiring 10,000 KW. It was built in 182 effective working days, and was put into operation on July 3rd, 1917. The arrangement is practically the same as at Livet.

The electric furnaces are charged by wagons tipped on to cast-iron travelling bands, which take the material to the electrodes. They are built in line at a distance of 30 metres apart from centre to centre, and are controlled from a control station situated between each pair, by hand. The furnaces are of the Ch. A. Keller single-phase type, with the electrodes in series.

After water sprinkling, the stripping of the pigs, still attached to the runners, is carried out by means of an overhead crane and a 2,000-kilogramme electromagnet. The entire sow and pigs are raised and dropped in the space between the furnaces, the impact breaking them into separate pieces; the electromagnet then loads them on wagons running along the front of the furnaces. A single workman can easily strip the bed, break up, and load up the 150 tons produced daily by each group of three furnaces.

The electrodes are agglomerated in sets of four, the individual rods being connected with the lead-in piece by a fused joint.

In order to provide for future urgent needs the power supply of the electro-metallurgical works at Nanterre has been increased to 15,000 KW., to be used in the nine single-phase 1,560-KW. furnaces housed in a melting shop 175 m. in length.

Simultaneously with the undertakings created at Livet, the Keller Leleux Co., in co-operation with the Société Générale d'Entreprises, established a works for the manufacture of synthetic cast iron, with the surplus energy developed at the Eymoutiers Hydro-Electric Works, belonging to the Departmental Railway Co. of Haute-Vienne.

The electric furnace, which is one of 1,000 KW., was worked in 1916 in parallel with the tramway system, practice having shown that this arrangement was advantageous.

A similar plant of 2,000 KW. has been laid down by the Keller Leleux Co. at Villefranche, to use the surplus power developed by the Midi Co. on its line from Perpignan to Bourg-Madame. This works has only just been completed.

The war stimulated extremely rapid development of the manufacture of synthetic cast iron owing to the abundance of steel turnings and the practical difficulties of using them. There is no doubt that a recarburising fusion by electric power derived from waterfalls constitutes the most economical mode of utilising such turnings, in so far as it involves a complete economy of coal. It is therefore towards electric furnaces supplied by water power that we must look for the utilisation of steel turnings, although the post-war conditions may modify the existing situation.

Lightning Phenomena.—An inquest was held on the body of Percival Simpson (41), who was killed while sheltering beneath an elm tree in Finsbury Park during a storm on the 14th inst. Other people sheltering beneath, and some who were passing the tree, were thrown to the ground, and rendered temporarily unconscious by the lightning. Only Simpson, who was struck, remained erect, and when the others revived they found him with his clothes on fire. The flames were extinguished, and he was taken to a building near by, where he expired immediately after the next clap of thunder. Death was attributed by the doctor to shock following a stroke of lightning, and the Coroner certified death as due to misadventure.

INCANDESCENT LAMPS FOR BIOSCOPE PROJECTORS.

The year 1917 saw the beginning of an extensive introduction of tungsten filament lamps into the moving picture projection field. The development of lamps for this purpose had its inception in the General Electric Co.'s research laboratory at Schenectady, U.S.A., where in conjunction with lamp manufacturers' co-operation it has been carried through to the commercially successful stage.

We drew attention to the advantages attending the use of incandescent lamps, run at an extremely high efficiency, for projectors in our issue of May 9th, 1913. For a long time it was thought impracticable to apply Mazda lamps to large bioscope projectors, but great though the obstacles seemed to be, they have been overcome. The enormous difference in brilliancy of the two sources was lessened by developing a new

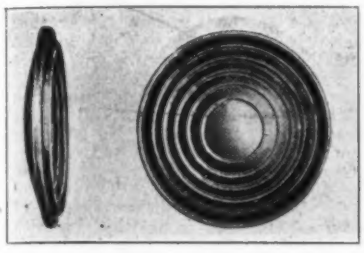


Fig. 1.—Condenser.

Fig. 2.—Mirror.

type of lamp and a new lens system. Probably the condenser plays the greatest part in solving the problem. Obviously, it was desirable to utilise a much greater solid angle of light than was intercepted by the plano-condensers commonly used. It was found impracticable to make a plano-condenser of sufficiently short focus as the thickness of the glass would be great and the curvature excessive, resulting in much spherical aberration. The difficulty was overcome by the design of a condenser somewhat similar to a semaphore lens, *i.e.*, it was a one-piece condenser made in steps, or corruga-

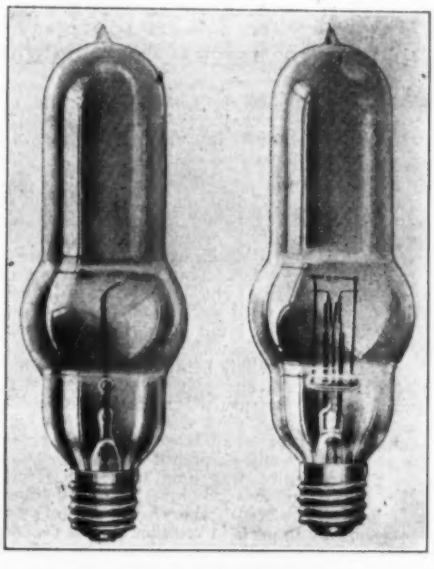


Fig. 3.—Front and Side Views of Mazda Bioscope Lamps.

tions (fig. 1). With this condenser a solid angle of 75 deg. was intercepted which immediately resulted in a very large increase in the amount of light flux available.

The condenser is 4 7/16 in. diameter, and is of 2½-6½ in. conjugate foci, meaning that the light source should be located 2½ in. behind the edge of the convex face of the condenser and the film 6½ in. ahead of the corrugated side. The former distance must be closely adhered to for best results, but the latter may be increased an inch or so without materially affecting the resultant illumination.

A further gain in illumination was obtained by the use of a spherical mirror (fig. 2) placed behind the light source. This arrangement practically doubled the available useful angle, making a net increase of from 32 deg. with the old plano-condensers to 150 deg. by use of the new condenser and mirror. The corrugations on the condenser also performed the further function of breaking up the filament image, resulting in a smooth and even screen illumination. The great increase in light flux thus obtained went a long way

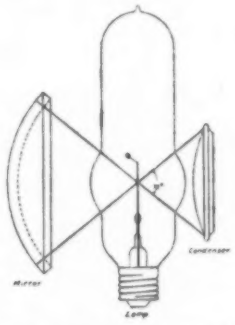


Fig. 4.—30-amp. Lamp, Condenser, and Mirror in Operating Positions.

toward offsetting the difference in operating efficiencies of the arc and the Mazda lamp. To further decrease this difference the lamps were operated very close to the melting point, resulting in high brilliancy and an average life of approximately 100 hours. The type of lamp finally chosen had a filament arrangement somewhat different from those in general use. It consists of four helices of tungsten arranged in one plane (fig. 3), which construction has a double advantage. First, it brings more of the filament close to the focus of the condenser; and, second, it enables the spherical mirror, when properly adjusted, to throw images of these filament coils back between the coils themselves, thus resulting in a virtually solid light source. Careful setting of the lamp, mirror, and condenser are necessary to obtain maximum results. Fig. 4 shows these elements in their proper relative positions.

The capacity of the lamp finally chosen was 750 watts operating at 30 amps. The determining factor was that the condenser would pick up light from a 0.4-in. square, hence a filament was designed which would place the greatest possible amount of light in that area. Low voltage (25) and high amperage are used because these call for heavier wire, and the greater the diameter of the wire the higher the tem-

Fig. 5.—Lamp Housing.

perature, hence the greater the candle power (within certain limits) that can be obtained therefrom.

Using a 25-volt lamp some economical means of reducing the line voltage of 110 or 120 to that of the lamp became desirable, and special compensators have been designed for use on A.C. circuits (motor generators are used for D.C. service), which consist of a compensator with either a rheostat or a reactance control in the primary, by means of which the secondary current can be regulated very closely, and exactly 30 amps. delivered to the lamp, regardless of whether the

primary voltage happens to be 105, 125, or any value between. An accurate ammeter on which to read the secondary current forms part of the equipment. This accurate control is of great importance. With the lamp operating at so high an efficiency as to give an average of but 100 hours' life, a very small amount of over current will reduce this life materially. As the lamps are fairly expensive, it is evident that the saving in lamp renewals will soon more than offset the additional cost of accurate control equipment.

A 600-watt lamp operating at 30 volts and 20 amperes has also been developed and may be used with gasolene generator sets. This lamp is made in a somewhat smaller bulb than the 30-ampere lamp, thus allowing the use of a smaller condenser and a smaller mirror. This is of advantage in machines for home use, portable machines, &c., where compactness and light weight is of value. As the lamp does not exceed the underwriters' limit of 660 watts, it may also be used on house lighting circuits, in schools, churches, &c., without special wiring. The "Compensarc" will control either the 750- or the 600-watt lamp.

Manufacturers of bioscope machines developed new housings containing the new lamp, condenser, and mirror with proper means for adjustment. One of these furnishes two lamps in the housing. Each is carefully focused before the picture is started, and then in case one burns out the other can be quickly substituted with practically no interruption to the picture. These housings (fig. 5) are inter-changeable with the old arc-lamp housings previously used.

TABLE I.—Lumens.

Objective focal length in inches.	4½	5	5½	6	6½	7	7½	8
Objective aperture.								
1½	325	261	216	—	—	—	—	—
1¾	440	355	294	247	—	—	—	—
2	577	464	384	323	275	—	—	—
2¼	727	588	487	409	349	300	262	—
2½	900	727	600	505	430	370	323	284
2¾	—	880	727	611	521	448	392	345
3	—	—	863	727	620	532	466	410
3¼	—	—	—	855	727	625	550	480
3½	—	—	—	—	845	727	635	557
3¾	—	—	—	—	—	833	727	640
4	—	—	—	—	—	—	830	727

It was found that by increasing the diameter of the objective lens a still greater increase in illumination resulted, approximately as given in Table I which is based on an arbitrary standard of 600 lumens for the 5½in. objective of 2¼-in. aperture.

Objective lenses in common use with arc lamps are 1¼ in. and 13 in. in diameter. There are available standard lenses of 2¼ in. diameter. These latter lenses will transmit exactly double the illumination of a 1¼-in. lens, and it is highly desirable to use the larger lens when changing from an arc to an incandescent lamp in large projectors. For the use of a Mazda lamp as a light source for the bioscope machine the following advantages are claimed: (1) Large reduction in operating cost; (2) better pictures, giving less eye fatigue, due to better colour and greater steadiness of light; (3) reduction in wear and tear on machine and film, due to ash from carbon arc; (4) less heat; (5) simpler control. The 750-watt lamp will replace any A.C. arc and D.C. arcs up to 40 amps., and will project pictures 12 ft. wide on a white plaster or cloth screen, or 16 ft. pictures on a metallic fibre, or glass screen.

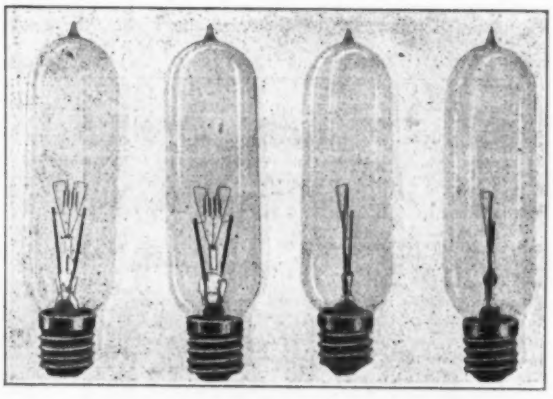


Fig. 6.—Front and Side Views of 600- and 900-watt Lamps.

Since the above particulars were published in the *General Electric Review*, December, 1917, a great deal of research work has been done, and considerable experience gained from service installations, with the result that some changes have been made in Edison Mazda projection. According to the July, 1919, issue of the journal referred to, the 750-watt lamp has been increased to 900 watts, and the bulb changed as shown in fig. 6. The new lamp operates at 30 volts, 30 amps. It is 10 in. over all, 2½ in. diameter, 3¾ in. light-centre length, and is fitted with a Mongul base; it is the same bulb as the 600-watt, 30-volt, 20-amp. lamp. The method of mounting the filaments in the bulb of both the 900- and 600-watt lamps has been changed somewhat from the construction shown in fig. 3; the relative settings of the lamp, lens, and mirror, however, remain the same. Because the 900-watt lamp is now in the same bulb as the 600-watt, it is possible to use a smaller mirror and condenser, if desired, which results in a more compact lamp housing, but has the disadvantages of more rapid mirror deterioration, due to its close proximity to the lamp, and shorter working distance between the condensers and aperture plate.

A new and more compact type of control has been developed, known as the Argus current regulator, which is made in two sizes, one for the 600-watt, and the other for the 900-watt lamp. By turning a handle on the device the proper lamp current may be maintained on any line voltage between 100 and 125. With this regulator it is necessary to use an ammeter in the lamp circuit; the meter should be located at least 2 ft. away from the regulator, so that the magnetic field from the latter will not affect its accuracy. Another type of regulator has been developed, known as the automatic or constant-current regulator, which has many advantages over the hand type of control. No matter how frequently the line voltage fluctuates, nor over what range within the limits of 105 to 125 volts, the regulator automatically holds the lamp current at exactly the proper value. No ammeter is required with this control, and when once properly installed it requires no further attention on the part of the operator, which feature will be appreciated. The control automatically protects the lamp from a heavy inrush of current when it is first turned on. This is not the case with the hand control, if the operator forgets to turn his handle to the starting position before closing the line switch. The advantages of this control should more than offset its slight additional cost. It is made in two sizes, one for each lamp.

The large housing (fig. 5) remains practically unchanged, and has proved most successful in service. There is now available an adaptor, known as the Argus adaptor, that may be attached to the front of an arc housing to allow of the use of incandescent lamps without removing the arc housing.

A line of tubular lamps has also been developed for use in small projectors and stereopticon lanterns for home and educational purposes. Round-bulb lamps will continue to be available for those projectors already in service with housings which will not accommodate the new lamps. The latter have the advantage of enabling the condenser to be placed closer to the filament, thus picking up a larger angle of light with a corresponding increase in screen illumination.

DIESEL ENGINE USERS' ASSOCIATION.

The Alignment of Shafts.

(*Abstract of paper read by* Mr. Geo. E. Windeler.)

It will be generally conceded that the alignment of an engine is one of the most important factors in regard to its construction. It is not essential that an engine bedplate should be absolutely dead level, as would be indicated by a spirit level (although it is certainly of some after value that it should be erected as nearly level as is possible for future reference), but it is more important that when an engine bedplate is laid down, its shaft should be lying in its bearings parallel with the top machined surface of the bedplate, and the shaft journals should be lying evenly and concentrically in the whole of the bearings in which they will work.

The first indication of a shaft being imperfectly supported in its bearings is excessive end play on the shaft with the fly-wheel running out of truth. This excessive end movement is produced by the springing of the crankshaft for want of support, and actually the shaft is extended and contracted in length by the opening and closing of the gap between the crank-webs. The difficulty was how to measure this distortion. The first step was to investigate whether the amount could be measured with the engine at rest, and the whole of the reciprocating parts in position, and it was decided to measure the distance between the crank-webs with a suitable instrument when the crank-pin was on the top centre, and when the crank-pin was on the bottom centre. Interesting results were obtained, and it was found that a few thousandths difference in the dimensions between the crank-webs when the crank-pin was on top and bottom centre, indicated that the shaft was out of line. This method was found to be especially valuable in regard to checking the alignment of outboard bearings. It was proved that, if a shaft was not being supported at a particular point, by placing the crank-pin of that particular line of parts adjacent to the unsupported bearing at (*a*) the top centre and measuring between the crank-webs at a predetermined point, and then (*b*) placing the crank-pin on the bottom centre and measuring as before, a distinct difference was noticed. If the bearing

was low the crank-webs would close in when the pin was on the bottom centre, and open out when the pin was on the top centre. If an outboard bearing was low the reverse was the case. From the readings taken it can readily be determined which bearing or bearings are low. This is a simple method which can be applied by anyone, and which does not require any special skill or training. Generally speaking, the amount of lack of support or the amount the particular bearing is out of line with other bearings (excepting in the case of the outboard) is approximately the difference between the readings when the crank-pin is at the top and bottom centre respectively.

The instrument used for these tests was an inside micrometer, having telescopic rods so that variable lengths could be dealt with, but it required very skilful handling. A second instrument was produced with which readings could be readily and reliably taken without any special skill. The special advantage of this method is that one can check at any time without removing any parts, whether the shaft is properly supported or otherwise, and the method is also particularly valuable when rebedding a new bearing into position, as it enables the refit to take place without removing other parts from the engine, and with a certainty that the whole of the bearing will be accurately in line, and that the new bearing will be supporting the shaft properly, and bearing its correct proportion of load. Any other method that I have investigated has invariably proved to be unreliable and unsatisfactory.

Discussion.

Mr. A. H. Dykes said that even if it was claimed that the idea was not altogether new, credit was due to Mr. Windeler for bringing the method prominently before engineers. When he first heard of the method, he did not feel at all sure that there might not be more spring in the shaft when the engine was working than when it was stationary, and that the opening of the crank-webs might be very little when the thrust of the piston was absent, but he was assured that this was not the case and that the method had proved perfectly reliable. Discussing the matter with a naval officer who had had charge of the Diesel engines on board H.M.S. *Benbow*, he was informed that in 1917 the method was in regular use on the *Benbow*, and that a special micrometer had been designed, very similar in principle to the one shown by Mr. Windeler. The method was a very useful one, but it must not be allowed to supersede periodical dismantling of the bearings for inspection.

Mr. P. A. Holliday agreed that the method should only supplement the periodical inspection of bearings. The method described had been employed by Messrs. Belliss & Morcom for a number of years. A point gauge and feelers were found to be quite satisfactory. The repeated gaugings should be taken from between the same points, and to accomplish this a slight indentation in one of the crank-webs for the purpose of taking one end of the point gauge would have the desired effect. Anything that could be done to keep a check on crankshaft alignment should be welcomed, as the strongest shafts were likely to fail if alignment were neglected.

Mr. F. Swarbrick said that the method could be carried out in the case of horizontal engines with equal success.

Mr. H. Squire asked whether some artificial load ought not to be placed on the piston head on top dead centre to approach working conditions when measurements were being taken between the crank-webs? He suggested that this could be accomplished by introducing the blast when the engine was on top dead centre. The measurements between crank-webs could then be noted with blast on and blast off.

Mr. H. S. Whiteley (communicated) gave particulars taken from a crankshaft, the measurements of the various bearings of which were abnormal. The crankshaft belonged to a two-cylinder, Burmeister and Wain engine, and had been running practically day and night since it was first installed in 1911 till the end of 1917. Owing to the increased end play on the shaft, together with the irregularity of the flywheel, it was decided to take the engine down for examination. The measurements were taken upon the same lines as Mr. Windeler indicated in his paper and showed also the extreme variation for each position of each bearing, before and after removal of the flywheel. The shaft was afterwards lifted out, placed between lathe centres, trued up by the end bearings, and the centre bearing was out of truth by .125 in. The shaft itself did not appear unduly worn, it was only slightly oval, and had a very fine surface. The webs of the crank nearest the flywheel were 8/1,000 in. open, this measurement being taken after the shaft was lifted out of its bearings. He thought it spoke well for this shaft, that it had not fractured long before.

Mr. G. E. Windeler, in reply, said that experience had proved beyond doubt that the method would remove, or at least reduce, very considerably, the risks of crankshafts fracturing through distortion under working loads. It was not intended to supersede periodical dismantling of the bearings, but rather to indicate by a simple and easily used method and device when they actually did require detailed and individual inspection and attention. He agreed that if some safe means of artificially loading the piston could be employed, the exact amount of deflection and want of support of the shaft could be obtained. The use of the blast air pressure would serve the purpose, but it might prove very unsafe. The eccentricity of journals, errors of roundness and inclination of axes of journals one to another must be dealt with and eliminated by the engine builder during the process of manufacture. If these errors were not removed, overheating, increased wear and uneven wear would take place in the bearings. The fact that the method had proved so valuable as a check to the alignment of outer bearings rather tended to prove that it could be usefully and reliably employed in other directions. He agreed that the shaft should be "nipped" down when checking the outer bearing for alignment. Mr. Whiteley's communication was very important; the figures spoke for themselves. The material used in the shaft was certainly of high ductility, and it would be of considerable interest to the members of the association if Mr. Whiteley could have some test pieces cut out of the shaft at different points and physical and micrographic records taken of the material.

BUSINESS NOTES.

Electric Welding.—On September 9th, members of the Engineering Section of the B.A. were conducted on a visit to the car depôt and generating station of the Bournemouth Corporation Tramways, where, among other items of interest, Mr. Bulfin, the general manager, had arranged an exhibition of the arc welding process. A heavy job in the form of a broken lug on a motor casing was very successfully repaired, and an interesting demonstration was given of the use of a new manganese steel electrode designed on entirely original lines. We understand that the results obtained were very successful, and marked a great step in the welding and depositing of this special steel. The whole of the electrodes, including the special manganese electrode, were supplied by Alloy Welding Processes, Ltd., of London.

Glasgow Exhibition.—We learn that excellent progress is being made with the organisation of the British Science and Key Industries Exhibition which opens in the Kelvin Hall of Industries, Kelvingrove, Glasgow, on November 17th. The stalls in the various sections are being rapidly taken up. In the chemical section, manufacturers of dyes have taken space. The South Metropolitan Gas Co., of London, will be represented. In the scientific instrument section the exhibitors so far comprise Barr and Stroud, Ltd., the Budenburg Gauge Co., Ltd., Kelvin Bottomley and Baird, Ltd., Henry Hughes & Son, Ltd., and Baird & Tatlock, Ltd. In the engineering section will be Vickers and their associated firms; William Beardmore & Co., Ltd., Glasgow; W. H. Allen and Son & Co., Ltd.; the Igranic Electrical Co., Ltd.; Arthur Lyon and Wrench, Ltd.; the Edison Swan Electric Light Co., Ltd.; and Messrs. Mavor & Coulson, Ltd. The Exhibition is being promoted by the Corporation of Glasgow.

The British Westinghouse Change of Name.—As our readers are aware the change of name of the British Westinghouse Electric and Manufacturing Co., Ltd., to that of Metropolitan-Vickers Electrical Co., Ltd., follows as a result of amalgamation with the extensive Vickers interests and the Metropolitan Carriage Wagon and Finance Co., Ltd. From its inception in 1899 until 1917, the then British Westinghouse Electric and Manufacturing Co., Ltd., was controlled by American shareholders, but in the latter year, as reported in these pages at the time, the American holding was taken over by the Metropolitan Carriage, Wagon and Finance Co., Ltd., and later amalgamation with the Vickers interests became effected. The company, therefore, becomes entirely British. We are informed that the change of name will not affect the general policy of the company except that a broader field for advancement will be opened up. The Metropolitan-Vickers Electrical Co, Ltd., will carry on just the same, but ultimately and inevitably will proceed to greater development. As a direct result of the amalgamation, much additional strength will be gained. Greater possibilities of competition in the markets of the world for the foreign trade will be effected; and a greater standardisation of engineering products, and consequently a larger and cheaper output, will become possible.

British Commercial Commissioner for Germany.—The *Board of Trade Journal* announces that Colonel J. W. F. Thelwall, M.C., has recently been appointed Senior British Commercial Commissioner in Germany, and is now at Berlin, where he may be addressed at the British Military Mission, Berlin. The duties of the British Commercial Commissioner in Germany will be analogous to those of a Commercial Secretary.

South African Electrical Market.—The *South African Mining and Engineering Journal* of August 30th, states:—"Tubing has at long last arrived, to the great satisfaction of dealers and contractors, who are now in a position to prosecute to an end the jobs which have been hung up for some months past on account of the absence of this requisite article. Business on the whole is brisk both in town and country. Materials are now coming in fairly freely, and there appears to be no shortage amongst the different electrical distributing firms. The coast, strange to say, are still short of stocks and are still worrying Johannesburg for supplies. Lamps remain as last reported, viz., 23s. per dozen, or 3s. each for the cheaper kinds. Notwithstanding the above one of the largest distributing agents reports that the present month has been the worst for business experienced by him for years past, as after the spurt caused by the festivities there has been practically nothing doing. Signs are, however, not wanting that next month will see a considerable increase in business. He says the mines are not buying to-day."

Internationalisation of Patents.—An International Congress was held at Brussels during the week from August 31st to September 6th, at which representatives of all the principal countries were present; the internationalisation of all patents was advocated. —*Board of Trade Journal.*

The Rise in Industrial Wages in Germany, 1914-1918.—The August issue of the *Reichs-Arbeitsblatt* (the journal of the German Department of Labour Statistics) gives the following official estimate of the increase in money wages of industrial workers in Germany during the war period. The average money wage of the adult male worker has risen between March, 1914, and September, 1918, *i.e.*, during the war period, from 5·17 to 12·46 marks, and that of women workers from 2·28 to 6·01 marks. The rise, as compared with March, 1914, amounts to 141 per cent. for men and 164 per cent. for women. Individual trades show greater increases. In the electrical trades, for example, during the period covered, men's wages have risen from 4·52 to 13·46 marks, or by 198 per cent.; in the engineering trade from 5·32 to 13·04 marks (145 per cent.). Wages of women in the metal industry have risen from 2·05 to 6·65 marks (224 per cent.): in the engineering trade from 2·28 to 6·26 marks (175 per cent.); in the wood-working trades from 1·99 to 5·45 marks (174 per cent.), and in the electrical industry 2·75 to 7·35 marks (167 per cent.) The increase in certain other trades has, however, been on a considerably lower scale. Men's wages in the food-preparing trades rose from 5·69 to 8·52 marks (50 per cent.); those of women in the leather and rubber trades from 2·82 to 4·82 marks (71 per cent.).—*Labour Gazette.*

The Austrian A.E.G.—The accounts of the A.E.G.-Union Electricity Co., of Vienna, after setting aside £30,000 for depreciation in 1918-19, as against £54,000 in the previous year, show net profits of £58,000, as compared with £77,000. The rate of dividend is 5 per cent., as contrasted with 8 per cent. in 1917-18.

I.O.C. Electrolytic Oxygen.—The INTEGRAL OXYGEN CO., LTD., of 38, Victoria Street, S.W. 1, referring to the article on page 157 of our issue of August 1st, 1919, regarding oxygen and hydrogen by electrolysis, informs us that it is now manufacturing, under licence, the I.O.C. generator as manufactured by the International Oxygen Co., of America, for which purpose the company has been formed.

New Spanish Company.—La Sociedad Electrificaciones Industrial is the name of a new undertaking which has lately been formed in Madrid with a capital of £200,000, to carry on works indicated by the title. It is understood that the first contract to be undertaken will be the electrification of the cranes and other plant at the Port of Pajares.

Scottish Oil Fusion.—A correspondent of the *Times* says that a new company, entitled Scottish Oils, Ltd., has been registered at Edinburgh to give effect to the arrangement made with the Anglo-Persian Oil Co. for the amalgamation of the several leading Scottish companies. The capital of the new company is £4,000,000. Control of the new company will be in the hands of the Anglo-Persian Oil Co., and important developments are expected. In West Lothian, where most of the oil works are situated, boring for liquid oil is being carried on vigorously by Messrs. Pearson & Son, under the direction of American engineers.

The Eight-Hour Day in France.—The "English" eight-hour working day has already made its appearance in various parts of France, with much satisfaction; but this is how it is managed at Colmar, according to a French employer. Opposite his factory is another works of about equal size, and after his staff have worked the regulation day from 7 to 12 and from 1 to 4, and leave at the sound of the works' bell, they pass to the works opposite, while the staff of his competitor there come over to his works, in each case to work three more hours. Thus, says the employer, the law is respected, the workmen are paid in both hands, and the output is not lessened. Only the grumblers of the locality are dissatisfied; but as the wives are pleased, this is a small matter.

Workmen's Compensation.—In the City of London Court last week, the case of Watson *v.* Telegraph Construction and Maintenance Co., Ltd., was referred to. Plaintiff, H. E. Watson, electric welder, of East Greenwich, while working for the defendants, met with an accident by which he lost the use of his right eye through the loose end of a wire hitting it. He was awarded £70 as compensation, and had received £40. He now asked for the remainder as he was going to Canada to take up farming out there. Sir John Paget, the Deputy Judge, said that the money would be no use to the plaintiff if he kept it in Court here while the young fellow was in Canada. He ordered him to receive the £30, and wished him good luck in his enterprise.

The Special Committee appointed by the Home Secretary to inquire into the working of the present system of workmen's compensation has received numerous letters from all parts of the country, complaining that the maximum compensation of 25s. a week allowed under the Act of 1906 is inadequate to meet the present-day high cost of living. All the complaints are from those who are totally incapacitated, and some of them are reduced to a state of semi-starvation. The Committee is giving careful consideration to the matter with a view, if possible, to securing an increase in the allowances to meet the new economic conditions.

Swedish Capital Increase.—The A. B. Janssons Elektriska Verkstad has decided to increase the share capital from 750,000 to 1,125,000 kroners by the issue of 3,500 new shares at par value.

The E.T.U. Opposes Engineering Amalgamation.—The *Birmingham Daily Post* states that a meeting of the London District of the Electrical Trades Union was held, on September 17th, for the purpose of discussing the question of amalgamation with the 14 other Unions in the engineering trade. The meeting was private, but at its close Mr. Ben Bolton (chairman of the London District) stated that it was proposed to take a ballot of the members by post. The London District Committee had passed a resolution in opposition to the scheme, and he and a number of others had advised that to amalgamate would be detrimental to the best interests of the workers employed in the engineering trades, inasmuch as it would perpetuate the "craft" system of organisation. If the ballot resulted in favour of amalgamation, it would have the effect of splitting the industrial organisation. At present their Union was open to all workers in the electrical trades, whether skilled or unskilled, and the latter by voting for amalgamation would be voting themselves out of the Union. Several members, he said, spoke in favour of the scheme, and a somewhat heated discussion followed.

Criticism of the 48-Hours' Bill.—In a letter to the Press, Sir G. B. Hunter, of Swan, Hunter & Wigham Richardson, Ltd., of Wallsend-on-Tyne, condemns the Government 48-hours' Bill, as being unsound and suicidal.

He says:—"There never was a time when it was less needed. There never will be a time when it could be so harmful as now," and concludes:—

"The British people cannot have either a materially or spiritually better world without doing more work, and unless that truth is recognised, vague rhetoric and camouflage about 'building up a new world where labour shall have its just reward' can only do harm and retard the coming of that better time. Governments can hinder, but they can do very little to hasten it."

The Wages (Temporary Regulation) Act.—A deputation of representatives of the Federation of Engineering and Shipbuilding Trades, Amalgamated Society of Engineers, and the National Federation of General Workers was received last week by Sir Robert Horne, the Minister of Labour, in regard to the peace basis of wages, and it was arranged that the Ministry of Labour should send a letter to organisations of employers and employés drawing their attention to the fact that the Wages (Temporary Regulation) Act will normally come to an end in November, and to the desirability of discussing the wages situation as soon as possible, so that the trades might arrive at an understanding as to the way in which wages questions were to be settled in future.—*Times.*

Non-Ferrous Metal Industry Act.—Lists of further licences granted under this Act were published in the *London Gazette* for September 19th and 23rd.

Book Notices.—The first issue of the *Technical Review*, formerly the "Technical Supplement to the Review of the Foreign Press," issued by the General Staff of the War Office, has come to hand; it is published at 20, Tavistock Street, London, W.C. 2, price 1s., and will appear fortnightly. In future it will cover both the technical and the commercial aspects of the engineering industries, and other developments are in prospect.

"Guide to the Study of the Ionic Valve." By W. D. Owen. Pp. vi + 59; 12 figs. London: Sir Isaac Pitman & Sons. Price 2s. 6d. net.

Scientific Papers of the Bureau of Standards, No. 338. "Some Optical and Photoelectric Properties of Molybdenite." Washington: Government Printing Office. Price 10 cents.

"Electric Spark Ignition." By J. D. Morgan. Pp. iv + 88; 39 figs. London: Crosby Lockwood & Son. Price 8s. 6d. net.

Trade Announcements.—MR. J. W. NORTON, electrical engineer, 23, Smithford Street, Coventry, having retired, his business has been taken over by Messrs. Norton & Marson, Ltd. Mr. Joseph Marson is managing director.

MR. S. WALLACE WILKINS, manager for Messrs. O. C. Hawkes, Ltd., up to the outbreak of war, has been demobilised, and become the managing director for Manufacturing Engineers, Ltd., of 281 and 283, Gray's Inn Road, W.C., at which premises he is reviving his old business in electric signs and heating apparatus for the trade.

The Gardy Co., who have very extensive works in Argentine, Paris, Meliana (Spain), and Geneva, inform us that they have greatly increased their output in all kinds of electric fittings and insulators. They are publishing new lists of their manufactures. MR. C. CAMPART, of 49, Newgate Street, E.C., is the company's London representative.

Australian Spelter.—A Reuter Melbourne report quotes Mr. Hughes, the Prime Minister, as stating in the House of Representatives of the Commonwealth that the Imperial Government had promised to advance £500,000 for the purpose of fostering the treatment of spelter in Australia, and that the Commonwealth would also assist in the establishment of similar works.

American Coal for Ireland.—Further information on the subject of American coals for Ireland goes to show that there is no great demand for them. In fact the orders received at Dublin were so small that they could not be seriously entertained. At least a 10,000-ton cargo was required for the quotation submitted by the American coal merchants, namely, 24s. free on board, the purchaser to pay transport, the cost of which has not yet been ascertained. The coal shortage in Dublin is assuming a more and more serious aspect, the recent supplies having been some 3,000 tons short of the usual, with an increased consumption *pro rata*.

Companies to be Struck Off the Register. — The following are to be struck off the register within three months unless cause is shown to the contrary :—

British Empire Lighting and Construction Co , Ltd.
Carbo-Welding Syndicate, Ltd.
Coal-Carbonishing Parent Syndicate, Ltd.
Electra Rubber and Vulcanite Syndicate, Ltd.
Oil-Fuel Gas Generator, Ltd.
Shipston Electrical Co., Ltd.
Thermo and Pressure Instruments, Ltd.

Economic Propaganda.—We have received from *Ways and Means* specimen copies of six pamphlets which they are publishing in response to the demand for educational matter on economic lines, for circulation among the workers. The titles are :—"Talks About Work and Wages" : (1) Value for Money ; (2) Mr. Wiseman Solves the Problem ; (3) Reduced Production ; (4) The Need for Industry ; (5) Mr. Wiseman and the Hours Question ; (6) Time is Money.

Catalogues and Lists.—The Edison Swan Electric Co., Ltd., Ponders End, Middlesex.—Large hanging show-card, in colour, depicting the "King of Lamps"—the Royal Ediswan—between the jaws of the King of Beasts, and not crushed at that.

The Aster Engineering Co. (1913), Ltd., Wembley, Middlesex. —Preliminary list indicating what are their various manufactures, and giving tabulated prices and particulars of Aster petrol and paraffin-electric generating sets, which they are turning out in large quantities for country house lighting, &c.

The Silent Electric Clock Co., Ltd., 192, Goswell Road, London, E.C. 1.—Forty-page illustrated brochure. The company was on the point of issuing a new catalogue in 1914, but the war stopped it. The catalogue now before us fulfils the pre-war intention, as the company returns to ordinary routine and manufacture. General descriptive matter respecting electric clocks leads on to the details of the "Silectock" system, and mechanism, and illustrations and particulars appear of master and receiving "Silectock" clocks, and other manufactures of the company.

Messrs. Welco Patents, 150, Alma Street, Birmingham.—Price folder relating to their "Welco" electric fire-stoves and stove fires.

Automatic and Electric Furnaces, Ltd., 281-283, Gray's Inn Road, London, W.C. 1.—*Bulletin* No. 14 describes the Wild-Barfield pouring furnaces.

Messrs. Siemens Bros. & Co., Ltd., Palace Place Mansions, Kensington Court, London, W. 8.—12-page illustrated catalogue, No. 538, containing brief particulars and prices of cases for pocket lamps and torches and dry-battery refills and Wotan lamps.

Messrs. J. H. Holmes & Co., Portland Road, Newcastle-on-Tyne.—60-page catalogue of their 2, 4, 6 and 8-pole D.C. motors and dynamos. It contains a great deal of information relating to "Castle" W type motors and dynamos—specification and descriptive matter, tables of output, prices, dimensions, weights, &c. Part of the contents relates to dynamos for battery charging, dynamos for welding and cinematographs, and dynamos for coupling to engines.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Four publications. No. 902 is a 40-page catalogue containing full specification particulars, also tabulated power, speed, efficiency, and price data relating to Aston ventilated and enclosed motors. No. 904, of 32 pages, describes and similarly particularises a variety of switchgear, including knife switches, heavy-service switches, fuses, ironclad switches, distribution boards, circuit breakers, battery switches, and switchboard accessories. Leaflet No. 901 tabulates prices, &c., of D.C. electric ventilating fans ; and No. 903, prices, &c., of desk, cabin, and saloon fans.

Messrs. Belling & Co., Derby Road Works, Montague Road, Upper Edmonton, London, N. 18.—Advance copy of their new catalogue (40 pages), wherein are given descriptive particulars, illustrations and prices, of their Belling patent electric fire-bar, various designs of their electric fires, also cookers, warming disks, kettles, toasters, irons, urns, water heaters, suction cleaners, and other electric labour-saving appliances for the home.

The Germans at Dantzig.—The Siemens & Halske Co. and the Siemens-Schuckert Co., following the example of the A.E.G., have now formed the Dantzig Siemens Co., with a share capital of £15,000, for the "manufacture and sale" of their products.

Durable Dry Cells.—Not every dry cell that one meets with is alive on the anniversary of its birth, even if no call has been made upon its stored-up energies. We have learnt with interest, therefore, from the British Ever Ready Co., Ltd., that a customer of theirs, who shut up his shop and went to the wars early in 1917, leaving 12 cycle lamps of the company's make in stock, returned two years later and found six of them "full up" ; the other six showed a light, but were not "full up." Another customer had a dry cell working a shop-door buzzer at frequent intervals for at least four years, and only lately had to replace it. We hope that the excellent records put up by these war-cells will be surpassed by their peace-time successors.

Dissolution of Partnership.—Carr, Geesin & Co., Electrical and mechanical engineers, 1, Montague Street, Russell Square, London, W.C.—Mr. T. T. D. Geesin and Mr. J. F. Carr have dissolved partnership. Mr. T. T. D. Geesin will continue the business.

Engineering Overtime.—The *Daily Telegraph* states that the engineering trade of Birmingham and district has arrived at an important agreement on the subject of overtime, which will now be permitted in so far as it applies to important reconstruction work or work preparatory to production.

Openings for British Trade.—An agent in Milan, with several years' experience with an engineering firm in the U.K., desires to obtain agencies for Italy for U.K. manufacturers of copper wire and insulated cables for electric current transmission. (Reference No. 662.)

Replies should be addressed to the Department of Overseas Trade, 73, Basinghall Street, E.C.

A Dutch Company's Expansion.—The Hengelosche Electrische en Mechanische Apparaten Fabriek, which name is usually abbreviated as the Heemaf, is raising a fresh issue of 1,500,000 florins (£125,000) by the emission of new shares of 1,000 florins, at the price of 130 per cent. According to the prospectus, the augmentation is due to the great extension of the works and of the company's connections both at home and abroad, which has already been made or is in progress.

Munitions Contracts.—*The Times* states that the Minister of Munitions has appointed a Committee, under the chairmanship of the Financial Secretary to the Ministry, for the purpose of expediting the liquidation of contracts in all Departments of the Ministry, and also to ensure greater co-ordination between the Liquidating and Accounting Departments and their associated services.

A Cologne Invitation.—A correspondent, "With the Army on the Rhine," sends us a copy of the *Cologne Post*, the "daily" published by our Forces there, containing the following advertisement, which he thinks may interest some British manufacturers :—"Wanted to buy in large quantities, dynamo and transformator sheet-iron and electrolyte copper. Offers in Marks free Cologne, to Franz Schmidt, Köln-Klettenberg."

LIGHTING AND POWER NOTES.

Athy (Co. Kildare).—E.L. Scheme.—The U.D.C. will, next month, appoint an engineer to prepare specifications for an electric lighting scheme.

Australia.—Sydney (N.S.W.).—Messrs. Preece, Cardew, Snell & Rider have, on the Council's behalf, placed an order with Messrs. Vickers, Ltd., for two rotary converters, at a cost of £11,138, f.o.b. British port, delivery having been promised by next Christmas.

The British Westinghouse Co. has accepted the Council's order for the two 12,000-kw. turbo-alternators running at 3,000 r.p.m., at the price of £140,000, f.o.b. British port, and the first set will leave the works on June 30th and the second by August 30th, 1920. This means that the first set should be ready for use before the end of the year 1920, and the second set well before the winter of 1921. To put these sets into use there are required, in addition to other things :—A new boiler house and boiler-house equipment, tenders for which will be opened next month ; the new power-house switchgear, tenders for which the city electrical engineer is working on ; a new salt-water conduit at Jones's Bay, the report on which, from Messrs. Vicars and Ross, is in the town clerk's hands. There is time enough to have the equipment completed before it is necessary to run the 12,000-kw. turbo-alternator, but not more, and the attention of the E.L. Committee was drawn to the necessity for dealing reasonably promptly with these works.

Aylesbury.—The T.C. has decided to supply electricity to small dwellings, which can be wired by the landlords, at 6d. per week, plus 20 per cent. The question of extending the supply to Wendover has been deferred.

Bath.—Year's Working.—The accounts for the year 1918-19 show a deficiency of £4,257, although there was a reduction of nearly £1,200 in the amount expended in the payment of interest on public loans and a reduction of nearly £1,100 in the amount that was placed to the sinking fund in connection with the repayment of loans. In 1916-17 the call on the rates was £1,783, and in 1917-18 a balance of £593 in hand was carried forward to help this account. The total expenditure for 1918-19 was £22,806, compared with £17,639 in 1917-18, and the total income £28,742, compared with £31,032. The profit dropped to £5,935, compared with £13,393. Interest on loans absorbed £5,068, compared with £6,228, and sinking fund payments £4,879, compared with £5,959 ; but depreciation and other charges involved £838, instead of £613. Instead of a net profit of £593, there was (including that balance in hand) a net loss of £4,256. Total cost of generating was £15,157 (£12,254) and total cost of distribution, £3,202 (£2,091). Sale of energy per meter at lighting rates, less discounts, £13,945, compared with £15,979 ; at power and heating rates, £7,146 (£8,562) ; public lighting, £4,118 (£3,696). The B. of T. units generated were 2,380,320. Sold : Public lamps, 147,405 ; by contract, 1,762 ; private consumers by meter, 1,630,028 ; the total sold being 1,779,195 ; used on the works, 149,243 ; on the external system, 451,882. The total maximum supply was 1,158 kw.

Bedford.—Extensions.—The T.C. is to proceed with the electricity extension scheme, which entails an outlay of £65,000.

Bedwellty.—The T.C. has appointed an E.L. Committee to go into the question of a supply of electricity for the town, either by the South Wales E.S. Co. or some other body.

Bradford.—Fire.—A fire broke out at the George Street electricity works on the 16th inst., and caused a good deal of damage. The station is divided into two parts, one of which is used as a sub-station. The Fire Brigade succeeded in isolating the Corporation part of the station so that the public supply of light will not be affected.

Bray (Co. Wicklow).—Price Increase.—The U.C. has decided to increase the rate for electricity for lighting to the maximum of 8d. per unit. The price to kinemas is to be increased to 4½d., heating and power, not less than 100 units per quarter, 8d.; where consumption exceeds 100 units per quarter, for the first 50 per KW. connected, 4d.; for all in excess of that, 2d. These prices are subject to a minimum charge of 6s. 8d. for June and September quarters and 13s. 4d. for December and March quarters, with 3s. 6d. for meter hire.

Bury.—Linking-up.—The Corporation E.C. has come to an arrangement with the Lancashire E.P. Co. for connecting the systems of the two undertakings at a point near the Radcliffe power station, and a Sub-Committee is to meet the Radcliffe Council with reference to the use of its station for the necessary equipment. The arrangement will mean that either body will be able to assist the other in case of breakdown.

Chobham.—E.L. Scheme.—The P.C. has appointed a Committee to meet a representative of the Woking E.S. Co. with a view to the mains being extended to the village for public and private lighting.

Continental.—Germany.—It is understood that the German Government contemplates voting 200,000,000 marks for electrification purposes in East Prussia, with the object of making the province independent of coal supplies from other parts of Germany.

Denmark.—The breakdown of the undersea cable between Sweden and Denmark, which occurred in July, temporarily put a stop to the transmission of electricity to the latter country. The difficult situation was met in a satisfactory manner by a supply furnished by the Skovshoved Elektricitets Werke.

A company of engineers left Norway in July for Iceland, with the object of establishing in the course of the summer an electric power station on the Sydland River. The projected railway from Reykjavik to the great Thjorsá River was also to be taken in hand.

Sweden.—It is reported from Gavle that the Soandvik Iron-works Co. has just begun to establish a hydro-electric works on the Dal River, at Lanforsen, which is estimated to yield 30,000 H.P. Mr. G. Bergren, the principal of the Stockholm city works at Untran, is the engineer for the work.

Dewsbury.—Proposed Extensions.—The Corporation has decided to ask the Government's permission to carry out extensions at the electricity works, which will involve expenditure of £83,000.

Dorking.—Price Increase.—The E.S. Co. has increased the price of electricity for lighting to 9d. per unit, subject to the consent of the B. of T., commencing with the quarter ending December next. There will also be an increase for energy supplied through slot meters, for weekly payment supplies, and for supplies by contract.

Dublin.—Fire.—Considerable damage was done by a fire at the South Lotts (Pembroke) electricity works, Dublin. It originated between the oil shed and the engine room, and the flames crept up a boarded partition to the roof of the main building. The loss is fully covered by insurance. Fortunately, the damage was not such as to interrupt the supply of energy to the district.

Edinburgh.—Annual Inspection.—Mr. Bruce Lindsay, the convener, and members of the Corporation Electricity Committee, with a number of officials and others, carried out the annual inspection of the electrical plant, last week. The new cable which is to supply power for the Leith Docks was inspected, and the visitors were much impressed with what they saw at the docks. The Leith Harbour Commissioners have their own power house, and the large internal-combustion engines attracted much attention. Naturally, the undertaking at Portobello—where the big new power house is being erected—came in for close attention. The foundations of the buildings which are to carry the generating plant are being laid in concrete, and the city architect explained how the work is being done. An important feature of the works at Portobello was explained by Mr. Newington, the Corporation's electrical engineer. This is the first of three tunnels which are being formed between the works and the sea for the supply of the water for cooling purposes required for the generating plant. The vertical shaft sinks to a depth of 60 ft. from the ground level, and turning then at right angles proceeds horizontally beyond low-water mark. The shaft and the tunnel have a diameter of about 10 ft. Later the company inspected the power plant at McDonald Road and at Dewar Place, where a new engine is being erected.

In the evening the Convener, who entertained the party at dinner, gave some interesting particulars regarding the latest developments of the industry. The new installation at Dewar Place, he explained, was a 5,000-KW. machine. At Portobello their plan was to put in three machines of 10,000 KW. He thought the Electricity Commissioners might possibly decree that the Edinburgh Corporation should be the district Distributing Committee. If that was the case, they need have very little concern about the provisions of the Electricity (Supply) Bill, which, so far as it had gone, was in pretty good shape from their point of view. They hoped that within two years they would see the Portobello installation in operation.

Glasgow.—Loan.—The T.C. is to apply to the Secretary for Scotland for authority to borrow an additional sum of £1,000,000. The memorandum is as follows:—Total borrowing powers, £4,071,478; total borrowed, £3,955,054; amount sanctioned but not borrowed, £116,424. Amount required for additional land for sub-stations, £20,923; buildings for sub-stations and for new Dalmarnock power house, £244,075; machinery and plant, £377,091; mains and cables, £300,000; meters, £18,000; transformers in consumers' premises, £64,000; balance of contracts in operation, £150,000; less balance of borrowing powers noted above, total, £1,057,666.

Glossop.—Price Increase.—The Urban E.S. Co. has increased the price of electricity, as under, from the quarter ending December:—Lighting, 8d. per unit; heating, 2½d.; supply under contract, 15 per cent. on present charges; weekly payment consumers, 1d. per week extra.

Godalming.—Price Increase.—The Urban E.S. Co. has increased the price of electricity, from the quarter ending December, to 10d. per unit for lighting, and 3½d. for heating.

Herne Bay.—Price Increase.—Messrs. W. E. Hunt and Sons, E.L. undertakers, have increased the price of electricity forthwith to 9d. per unit for private lighting, and 4½d. for power and heating and for kinema arcs. The U.D.C. has decided to have the sea front lit by electricity by Messrs. Hunt & Sons.

Heston and Isleworth.—Price Increase.—An increase of 25 per cent. in the price of energy is announced.

Lepton.—Bill.—The U.D.C. has unanimously decided to support the Huddersfield Corporation Electricity Bill.

London.—Poplar.—As from October 1st next, charges for power and public lighting are to be increased by a further 15 per cent., and private lighting by a further 20 per cent., making a total increase of 65 per cent. and 50 per cent. respectively.

Cost of City Lighting.—The Corporation is to inform the Board of Trade of its opposition to the application of the Charing Cross, West End, and City Electricity Supply Co. to increase to 8d. the maximum price of electric lighting in the City, having regard to the 6d. per unit granted to the company last year.

Loughrea (Co. Galway).—The post office in the town of Loughrea (Co. Galway) is the only house there that does not share in the electric light supply provided by a committee of local traders.

Mansfield.—Loan Sanction.—The T.C. has received sanction to a loan of £20,500 for generating plant, and has applied for a further loan of £14,000 for the extensions to the buildings.

Price Increase.—The price of energy is to be increased by a further 10 per cent. from October 1st, making a total war advance of 60 per cent.

Meltham.—The U.D.C. has received applications from the Huddersfield Corporation and the Yorkshire E.S. Co. for sanction to supply electricity in the Meltham area, and has decided in favour of the Huddersfield Corporation.

Oldham.—Loan Sanction.—Sanction has been received to borrow £35,000 and £15,000 to meet prospective expenditure on mains, transformers, and switchgear, in the electricity department.

Plymouth.—Loan Application.—Application is to be made to the M.H. for sanction to borrow £69,750 for the provision of additional plant for the electricity works. It was estimated that £40,000 additional revenue will accrue annually from the new installation.

Richmond-on-Thames.—Price Increase.—The E.L. Co. has informed the T.C. that it is applying for authority to increase the price of electricity by another 30 per cent., instead of 20 per cent. as intended.

Ross (Hereford).—The Ross D.C. has consented to the Hereford C.C. supplying electricity to all the parishes in the Ross rural district.

S. Africa.—Cape Town.—The T.C. has now on order two large boilers, one of which it is hoped to receive during the coming summer; but if not received, the position during the next winter will be very serious. An additional 3,000-KW. generator has also been ordered, and it is hoped that this will be received and erected during the next nine months. The Council also ordered in March, 1917, certain cable, and forwarded the lead required for the sheathing, but this cable is still undelivered. Owing to these delays in delivery, the Council is unable to allow new consumers to be connected to the system.

Saltburn.—Public Lighting.—The U.D.C. has decided to substitute electricity for gas for public lighting, and has accepted the tender of the Cleveland Trust Co. for the installation, which will involve a capital outlay of £1,530.

Sheffield.—Year's Working.—Alderman A. J. Hobson told the T.C. that the Corporation electricity department was contributing £15,000 to the relief of the rates. This is the first payment made by the department. The accounts for last year show that the revenue amounted to £735,145, and the expenditure to £470,944, leaving a balance of £264,201. Out of this sum had to be taken £194,907 for interest, sinking fund, and income-tax, and £69,203 for renewals, special expenditure fund, and other items. The sum of £802,893 has been paid into sinking fund for redemption of debt up to March 25th last. The number of units sold during last year was less by 10,611,966 than the previous year, owing to the cessation of hostilities. The percentage of working expenses in proportion to total revenue is 66 as compared with 58 for the previous year, a favourable comparison considering increases in wages, the higher price paid for coal, and the extra income-tax chargeable. The total number of consumers is 7,964, an increase of 242 during the year, and the total connections amount to 149,802 kw., an increase of 16,653 kw., or 13 per cent. Considerable progress has been made with the emergency power station at Blackburn Meadows, and it is expected that plant will be running some time during the current year. The department has been responsible for the installation of 6,163 h.p. of motors, out of a total of 15,667 h.p. connected during the war.

Stamford.—Proposed Price Increase.—The Urban E.L. Co. has notified the T.C. of its intention to apply to the B. of T. for permission to increase the lighting charge to 10d. per unit, and that for power to 6d. per unit. The T.C. is to oppose the application.

Stirling.—Price Increase.—The T.C. has advanced the price of electricity to 7½d. per unit for lighting, to 2d. for heating, to 7½d. for slot meters, and for power to 25 per cent. increase.

TRAMWAY AND RAILWAY NOTES.

Colne.—Proposed Extensions.—The Corporation has under consideration a proposal to extend the tramway system to Earby.

Egypt.—Strike.—It is reported that a compromise has been reached between the strikers and the Heliopolis Railway Co. for a period of one month, when the strikers' principal demands will receive consideration.

Dewsbury.—Extension of Time.—The Corporation has made an application to the B. of T. for an extension of the time limit for the completion of the tramway authorised to be constructed by Section 5 of the Dewsbury Corporation Act, 1915.

Glasgow.—The T.C. has authorised the manager to arrange for the making of armature coils in the tramway department.

Halifax.—Fare Increase.—Application is to be made to the B. of T. for permission to increase the tramway fares. The Corporation has only power to charge 1d. a mile, but about a year ago some re-adjustment of stages took place whereby the fares on those routes upon which more than one mile was traversed for 1d. were increased.

Huddersfield.—Accident.—An accident occurred to one of the Corporation coal tramcars while proceeding with a load of coal on September 19th; the equipment underneath the car caught fire and the cable was burnt. As a consequence, there was a stoppage of traffic for some time.

London.—On and after October 1st, a number of the additional trains which have been running on the North London electric railway on Sunday afternoons between Broad Street and Kew Bridge will be discontinued. On week days an additional train will leave Broad Street for Richmond at 6.55 a.m., and for Kew Bridge at 8.52 a.m.

Accidents.—In a collision between an omnibus and an L.C.C. tramcar at Camden Town, the conductor was thrown from the top of the 'bus and seriously injured.

A tramcar jumped the metals in the High Road, Chiswick, on Tuesday, but stopped before it reached the pavement.

A mishap on the Underground Railway, early on Tuesday, caused delay and congestion of traffic.

A tramcar at New Cross Gate junction stopped on the dead section; while a second car was pushing the first on to the live section, a tramway employé touched the plough, and receiving a shock, was rendered unconscious.

At the adjourned inquiry held on Saturday concerning the deaths of A. H. J. Jackson, 47, and R. Curson, 66, who died as a result of a tramway car smash in Pancras Road on the 16th ult., the jury returned a verdict of "Accidental Death," adding that they were of opinion that the driver of the tramway car was in no way responsible for the accident, and complimenting him on remaining at his post till the tramway car was overturned. They were further of opinion that the speed of all tramway cars travelling down to the curve at the corner of Great College Street should be reduced considerably from the speed at which they are at present usually driven.

Newcastle-upon-Tyne.—Bill.—A report from the Parliamentary Committee relative to the promotion of a Parliamentary Bill for tramway purposes, stated that in the course of the successful opposition by the Corporation in the Session 1913-14 to the North-Eastern Railway Co.'s proposals to run trackless trolley omnibuses over the railway company's high-level bridge, an undertaking on behalf of the Corporation was given to the House of Lords' Committee to apply in the 1914-15 Session for powers to carry tramways over the bridge which would serve to connect the systems in operation in Newcastle-upon-Tyne and Gateshead. Owing to the war the fulfilment of the undertaking given to the Lords' Committee was unavoidably frustrated; and it is therefore proposed that the negotiations which took place in 1914 and 1915 should be revived by the Tramways Committee, and that the proposals for tramways over the high-level bridge connecting the Corporation tramway system with that of the Gateshead Tramways Co. should in due course be proceeded with. It is also intended to seek power in the Bill to extend the tramway into the Weetslade urban district, or arrange a motor-'bus service thereto; further, to obtain powers of compulsory acquisition of land for the widening of Benton and Whitley Bay main road, with a view to tramway extensions in the future.

St. Helens.—With the taking over of the tramway system by the Corporation on October 1st, the Tramways Committee has been considering the advisability of operating the Haydock to Ashton-in-Makerfield section from the Ram's Head, Haydock, to which the Corporation powers now extend, to the tramway waiting-room at Ashton, and terms have been arranged for operating this section of the South Lancashire Tramway Co.'s system. The tramway manager recently appointed by the Corporation has been instructed to obtain prices for six single-deck cars. In view of the difficulty of obtaining new cars, the manager has arranged to hire four cars from the South Lancashire Tramway Co., at 10s. per day each, the Corporation to carry out running repairs, and reserving the right to return all, or any, of the cars at any time at one week's notice.

New Cars.—The Tramway Committee has accepted tenders of the Brush Electrical Engineering Co. for the supply of eight new cars with vestibules, and the British Thomson-Houston Co. for the supply of electrical equipment for them.

Loan.—The Committee has also decided that application be made to the B. of T. for sanction to borrow £17,500 for tramway purposes.

The Transport Ministry.—The new Ministry of Transport, with Sir Eric Geddes at its head, began its formal existence on Tuesday, in Whitehall Gardens, London.

Tramway Employés' Wages.—An interim Court of Arbitration sat at the Central Hall, Westminster, on Tuesday, to take evidence in connection with the demand of the National Transport Workers' Federation. The proceedings were in private, but it is stated that evidence was tendered for the L.C.C. showing that fares had been increased to the point of equilibrium, and could not economically be raised higher. It was asserted in evidence that the L.C.C. system is now being carried on out of capital. Sir Linden Macassey said the total amount of wages in the whole arbitration was three millions per annum in addition to the bonuses already granted. In the other cases considered it was shown that tramways were now involving a loss which was being borne by the ratepayers. By consent the Court has removed from the terms of reference the merging of war bonus into permanent wages, and the reduction of the qualifying period for the maximum wage. The Court adjourned shortly after six o'clock, and the arbitrators proceeded to Bristol, where they resumed their investigations on Wednesday. They will afterwards go to Manchester and Glasgow.

United States.—Fare Increase.—A large number of American tramway companies are obtaining authority from governing bodies to increase their fares. Owing to the present conditions the 2½d. universal fare has in many cases become impracticable, and many of the companies are faced with serious financial difficulties. In one instance, while consent was obtained to nearly double the fares, the order requires the company to increase the service.

TELEGRAPH AND TELEPHONE NOTES.

British Guiana.—As a result of the frequent and prolonged breaks in the contract cable service, causing delay and pecuniary loss in official and commercial telegrams, the Admiralty has authorised the transmission of telegrams by the naval wireless station at Demerara to Bermuda for the United Kingdom, and to Jamaica for the United States, and *vice versa*, while the cable continues to be interrupted. The Colonial Government has also given permission to ships in the harbour to dispatch commercial messages by their wireless apparatus.

Canada.—The telegraph companies operating in Canada have applied to the Dominion Railway Board for permission to increase telegraph rates. The present rates have been in effect since 1916.—*T. & T. Age.*

Corsica.—Experiments in wireless telephony are now taking place between stations on Porquerolles Island, near Cannes, and Aspretto, near Ajaccio (Corsica). Messages of 150 and 200 words have been transmitted with complete success.

France.—The principle of Sunday rest was on Sunday last applied for the first time in the postal and telegraphic services. It means an almost complete stoppage of the postal services on Sunday.

Pacific Cable.—It is stated that the U.S. Government has practically abandoned the project of laying a cable across the Pacific Ocean connecting with the Philippines, Japan, and China, and will leave it to private enterprise. The laying of such a cable is now contemplated, says the *Times*, by the Commercial Pacific Cable Co.

Holland.—A Bill has been introduced in the Dutch Second Chamber of the States General to authorise the Minister for the Colonies to pay the German Netherlands Telegraph Co., of Cologne, a sum according to the agreement between the Governments of Holland and Germany of July 24th, 1911, providing for the payment of an annual subsidy of 370,000 marks. The payment is reckoned from the third quarter of 1914, at the exchange of 59·25 fl. per 100 marks, less the sum already paid by the Dutch Government in the meantime. In the preamble the Minister states that he considers the maintenance under Dutch supervision of a connection between Menado and the world's telegraph system to be of great importance both for Holland and the Dutch East Indies, and that it is desirable to meet the company as far as possible.

Madeira.—The Portuguese Government is considering purchasing from the British Navy the wireless installation now at Madeira for Porto Santo, and procuring a more powerful apparatus for Madeira. Firms interested should communicate with the Minister of Commerce, Lisbon, Portugal.—*T. and T. Age.*

Magnetic Storm.—Aurora Borealis electrical disturbances of an unusually severe nature interfered with the operation of U.S.A. telegraph lines on August 11th, says the *T. & T. Age.* The disturbances were felt throughout the entire country; not only throughout the North and West, as is generally the case, but on circuits running north and south along the Atlantic seaboard. Induced currents of a strength above one-tenth ampere were observed in some circuits.

Sweden.—The L.M. Ericsson Co., the Gas Accumulator Co., the Svenska Allmane Co., and two banking institutions have formed the A.B. Svenska Radiotelegraf, with a share capital of 3,000,000 kronen, for the purpose of undertaking experiments in connection with wireless telegraphy. The shares have been subscribed privately, and the object of the company is to combine the work which the first three companies have carried on individually for some time past.

Turkey.—In a circular to the shareholders the directors of the Constantinople Telephone Co. state that they have succeeded in obtaining possession of the company's property, under an agreement with the Turkish Government, that modifies in a way which, for the time being, is satisfactory, the terms of carrying on the service, and reserves all the claims of the company against the Government. It is proposed that the working of the system from March 15th, 1915, to April 1st, 1919, shall be for the account of the Turkish Government, on condition that the Government provides the sum necessary to pay interest to the bondholders and shareholders for that period.

Uruguay.—On June 12th, 1919, the Uruguayan Ministry of Industries aurhorised the Central and South American Telegraph Co. to bring into Monte Video one or two cables coming from Rio de Janeiro and Santos, or from one of these cities. This company was authorised in September, 1918, to extend its telegraph and telephone lines from Buenos Aires to Monte Video.—*T. and T. Age.*

U.S.A.—The *Electrical World* of July 26th gives an abstract of the Bureau of Census report on the development of land telegraph and wireless systems in the United States in 1917. There was a small increase in the mileage of wire, but a large increase in traffic on the land systems. The printing telegraph came into extended use by telegraph companies, Press associations and railways during the period 1912-1917. The use of the telephone for train dispatching has increased rapidly; and not a single accident has resulted from the use of telephones in this service. There has been great development in wireless installations and traffic, and on June 30th, 1918, there were in operation 134 commercial shore stations, 838 commercial ship stations, 135 Government shore stations, and 470 Government ship stations. The Arlington station had been in regular communication with Chollas Heights, near San Diego, since May, 1917. Direct communication with an Italian Government station in Rome was also established. Messages are now transmitted between Arlington and the Philippines *via* San Diego and Pearl Harbour, Hawaii. Under favourable conditions, Arlington can communicate direct with Pearl Harbour.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia.—SYDNEY.—November 10th. City Council. Supply of electric motors. Particulars from Electric Lighting Department, Town Hall, Sydney.

October 13th. City Council. Three 2,000-K.V.A., 33,000/5,000-volt, transformers. Electric Lighting Department, Town Hall, Sydney.

December 19th.—Metropolitan Board of Water Supply & Sewerage. Centrifugal pumps, electric motors, &c., for the low-level pumping station, Marrickville. Offices of the Board, 341, Pitt Street, Sydney.*

MELBOURNE. — P.M.G.'s Department. January 20th, 1920. Automatic telephone switchboard at Collingwood. Schedule 1,583. (September 19th.)

December 3rd. Victorian Railways. Portable electric welding set and accessories. Secretary for Railways, Spencer Street, Melbourne.*

Bradford.—October 9th. Electricity Department. Two 1,500-KW. rotary converters, transformers, &c.; induced draught plant and chimneys, and three economisers. (September 12th.)

Dundee.—October 8th. Electricity Department. E.H.T. switchgear and concrete cell-work at the Carolina Port Main generating station. Section "A," switchgear for one 5,000-KW. turbo-generator and six feeders; section "B," alterations and additions to present switchgear, for two 5,000-KW. turbo-generators, one feeder and one 500-KW. transformer. (September 19th.)

Edinburgh. — October 13th. Corporation. Electric lighting installation under the new housing scheme. (See this issue.)

India.—LAHORE.—Electric Supply Co. Generating plant, two 1,000-KW. and two 500-KW., three-phase, 6,600-volt turbo-alternators, &c.; boilers, mechanical stokers, &c.; sub-station plant, H.T. and L.T. mains, &c. (Specifications available October 1st.) (September 5th.)

Kilmarnock. — October 3rd. Electrical installation, Holehouse Road. Housing scheme for the T.C. Borough Surveyor

Madagascar.—March 1st, 1920. Directeur des Travaux Publics à Tanarive. Installation of electric station, with equipment, at Falls of Volobe, near Tamatave; erection of overhead transmission and distribution lines, and establishment of service in the city. Ministère des Colonies, Paris.

Paris.—October 6th. Administration des Chemins de Fer de l'Etat. Electrical and mechanical equipment for the extension to the Rouen generating station. Bureaux du Service électrique (I. division), 43, Rue de Rome, Paris.

New Zealand.—NAPIER.—September 30th. B.C. Tramway rails, points, crossing, special trackwork, &c.; trolley, test and span wires; tramway poles and sleepers. Town Clerk, Borough Council, Napier.*

St. Helens.—October 4th. Electricity Committee. One 5,000-KW. steam turbine, with condensing plant and auxiliaries. (September 19th.)

Warrington. — October 7th. Electricity Committee. H.T. and L.T. lead-covered cable. (September 19th.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

CLOSED.

Cape Town.—Corporation. Eight tenders were recently received for alternating current switchgear, ranging from £58,700 to £25,988. Eventually the tender of the South African General Electric Co., on behalf of the General Electric Co. of America, was accepted for £28,278. This figure includes erection at a cost of £2,750, but it is intended to leave this item over until it is possible to ascertain whether a suitable man is available in the country to superintend the work on behalf of the Council.

Exeter.—T.C. :—

Three electric vehicles, £1,304 each.—Edison Accumulators, Ltd.

Glasgow.—Tramways Committee. Recommended :—

Trolley wire.—F. Smith & Co., Ltd.
Motor-generator set.—British Westinghouse Co., Ltd.
Rail welding.—The Rail Welding Co.

The Committee has considered applications by the following contractors for increases in their contract prices, viz. :—Ferguson, Son & Co., Ltd., Carron Co., Carntyne Steel Castings Co., and Miller & Co., Ltd., and has recommended that the applications be not acceded to.

Government Contracts.—The following contracts were placed during August, 1919 :—

WAR OFFICE.

Maintenance of Lifts: London District.—Waygood-Otis, Ltd.

INDIA OFFICE: STORES DEPARTMENT.

Accumulators.—Tudor Accumulator Co., Ltd.
Alternator.—Lancashire Dynamo Co., Ltd.
Armatures.—Laurence Scott & Co., Ltd.
Cable.—Pirelli General Cable Works, Ltd.; Callender's Cable and Construction Co., Ltd.; B.I. & Helsby Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; W. T. Glover & Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Macintosh Cable Co., Ltd.
Cells.—Chloride Electric Storage Co., Ltd.
Crucibles.—Morgan Crucible Co., Ltd.
Fans.—Veritys, Ltd.
Lamps.—General Electric Co., Ltd.
Meggers.—Evershed & Vignoles, Ltd.
Motors.—British Westinghouse E. & M. Co., Ltd.
Wireless stores.—Marconi Wireless Telegraph Co., Ltd.
Receiving sets.—Marconi Wireless Telegraph Co., Ltd.
Searchlights.—Chance Bros., Ltd.
Stress recorders.—T. Cooke & Sons.
Wire.—Elliott's Metal Co., Ltd.; T. Bolton & Sons, Ltd.; F. Smith & Co., Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co.; B.I. & H. Cables, Ltd.

POST OFFICE.

Laying ducts.—Loughborough-Derby (Section II): H. Ashley; Derby-Manchester (Section V): W. Turner; Glasgow (Western): Greig & Matthews.
Laying ducts and pipes.—Southampton-Bitterne: J. A. Ewart, Ltd.; Loughborough-Derby (Section III): H. Ashley; Upper Kennington Lane: J. A. Ewart, Ltd.
Laying ducts and troughing.—Southfields, S.W.: W. H. Wheeler & Co., Ltd.
Supplying, drawing-in and jointing cable.—Glasgow-Dumbarton: B.I. & H. Cables, Ltd.; Sevenoaks-Tunbridge Wells: W. T. Henley's Telegraph Works, Co., Ltd.; Glasgow-Coatbridge: B.I. & H. Cables, Ltd.; Rawtenstall-Bacup: Johnson & Phillips, Ltd.
Telephone Exchange equipment.—West Bromwich: Siemens Bros. & Co., Ltd.; Clerkenwell: Peel-Conner Telephone Works, Ltd.
Protective apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.
Telephone apparatus.—British L.-M. Ericsson Manufacturing Co., Ltd.; Phœnix Telephone and Electric Works, Co., Ltd.; Sterling Telephone and Electric Co., Ltd.; Western Electric Co., Ltd.
Wrought-iron brackets.—Bullers, Ltd.
Telegraph and telephone cable.—B.I. & H. Cables, Ltd.; Johnson & Phillips, Ltd.; New Gutta-Percha Co., Ltd.
Secondary cells.—Fuller's United Electric Works, Ltd.; Hart Accumulator Co., Ltd.
Cords for telephones.—Phœnix Telephone and Electric Works, Ltd.; Western Electric Co., Ltd.
Ducts.—Doulton & Co., Ltd.
Earth plates.—Walkers, Parker & Co., Ltd.
Jointing sleeves.—C. M. Powell Bros.
Cable suspenders.—E. & J. Richardson.
Amplifying valves.—British Thomson-Houston Co., Ltd.
Insulator bronze wire.—B.I. & Helsby Cables.
Steel wire.—Whitecross Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Alternator coils.—Ateliers de Construction Oerlikon.
Cables, &c.—Siemens Bros. & Co., Ltd.
River cable.—Hooper's Telegraph & India-Rubber Works, Ltd.
Insulators and spindles.—Bullers, Ltd.
Motor-generators, &c.—British Thomson-Houston Co., Ltd.
Rotor controllers.—British Switchgear, Ltd.
Switchboard controllers, &c.—British Switchgear, Ltd.
Telephone line material.—Siemens Bros. & Co., Ltd.; Bullers, Ltd.
Copper wire.—Shropshire Iron Co., Ltd.; Elliott's Metal Co., Ltd.
G.I. line wire.—R. Johnson & Nephew, Ltd.

H.M. OFFICE OF WORKS.

Engineering services.—Storage battery, &c., Premier Accumulator Co., Ltd.
Switches and switchboards.—Ferguson Pailin & Co., Ltd.

Rushden.—U.D.C.:—

Motor generator plant, £133.—Siemens Bros.

Southend-on-Sea.—T.C.:—

900 tramway bonds, £15.—Blackwell & Co.
150 tons of steel rails, £3,700.—Walter Scott, Ltd.

FORTHCOMING EVENTS.

International Shipping, Engineering and Machinery Exhibition.—September 25th to October 17th. At Olympia, West Kensington, W.

Junior Institution of Engineers.—Friday, October 3rd. At 19, Victoria Street, S.W. At 7.30 p.m. Paper on "The Deduction of Formulæ from Plotted Figures," by Mr. A. J. Paxman.

NOTES.

Ireland's Resources.—At the annual Conference of the Association of Municipal Associations in Derry, last week, Mr. P. J. M'Andrew, B.A., consulting engineer, Dublin, read a paper on "The Economic Development of Ireland." He said that there was not a moment to be lost in the economic development of Ireland's fuel supply. There were (*a*) lignite deposits on both sides of Lough Neagh, at Antrim, Tyrone, and at Portrush, which, from a fuel standpoint, were as valuable as a South Wales coal-field; (*b*) other available fuel resources were the coal-fields of Arigna, Wolfhill, Castlecomer, Castleconner, Tipperary, and Carlow. The lignite was in the heart of industrial Ulster, and within 20 miles of Belfast, with railways and canals available for carrying the manufactured article to different parts of the country. Dealing with the water power of Ireland, he said that they possessed at least 120,000 H.P. in the Shannon, Bann, Erne, and Corrib, apart from smaller waters, which might be economically developed for the establishing of industries. The main water power was capable of driving all the industries of the country at a fraction of the cost as compared with coal, and could work railways and tramways throughout the country. The plans and estimates were ready, but the Irish Hydro-Electric Syndicate, owing to the disturbed state of the country and of the labour market, was reluctant in advancing a scheme unless Irishmen themselves were interested in it.

The Australian Telephone Service.—In opening the new automatic telephone exchange at Malvern on July 28th last, the P.M.G. said, according to the *Age*, that the cost of the installation totalled £45,000, and the new building £8,450. In Malvern district there were 3,129 subscribers connected with the system, and there was room for an additional 8,000. In the old exchange there had been 2,514 subscribers, and a total of 53 operating attendants and mechanics, whereas in the new exchange only 15 persons were required. Referring to the cost of the telephone in Australia, Mr. Webster claimed that there were only three countries in the world with cheaper services—Norway, Sweden, and Switzerland. Despite the high war prices, he had not charged the public any more for the service, and yet last year the Post Office had shown a big surplus, and he was hopeful of again showing a surplus this year. Automatic exchanges had been installed in various parts of Australia. In Perth the subscribers numbered 4,000, and the system worked perfectly. In the Melbourne automatic exchanges there were 7,500 subscribers, with the possibility of an extension to 15,000; in Sydney there were nine exchanges, with 36,000 subscribers, and scope for twice the number on the same installations.

Interesting particulars as to cost and progress up to the present of the work of installing automatic telephones, are given in the eighth annual report of the Postmaster-General, for the year ended June 30th. The financial stringency, it is stated, has operated adversely in connection with proposals for new automatic telephone installations. The department proposed to install five new automatic exchanges, Sydney (City North), Malvern (Melbourne), Ascot, Canterbury, and Collingwood (Melbourne), the amount involved being £223,000, with an additional £35,000 for buildings. Although satisfactory tenders were received in 1916, it was only after much delay that authority was obtained to accept tenders for the Sydney, £81,846, and Malvern, £44,998, exchanges. The other three were cut out. The building in which the automatic exchange will be housed in Sydney is nearing completion, and the equipment is to hand for the installation of the first section of a complete automatic service. The capacity of the complete automatic system will be 20,000 lines, of which 2,500 are now being installed, but the delay mentioned, and the rapid growth, will necessitate a further installation of 2,500 lines at no distant date. It is estimated that the life of the present common battery board will expire inside the next decade, and the transfer to the automatic system should then be completed. Had this change been deferred, and tenders offered not been accepted, the telephone system in Sydney would have been inadequate to meet demands in another year or two, while the cost would have risen at least 25 per cent.

National Insurance (Unemployment) Acts.—FURTHER DECISIONS BY THE UMPIRE.—A. The Umpire has decided that contributions are payable in respect of:—

2,453 X. Workmen engaged in making metal containers for electric flash lamps.

2,457 X. Apprentices (employed wholly or mainly by way of manual labour in any trade set out in the First Schedule to the National Insurance (Part II) (Munition Workers) Act, 1916, or in munitions work) who were formerly indentured, whose apprenticeships have been interrupted by war service, and who are not covered by decision No. B 2,456 below:—

2,458. Apprentices (employed wholly or mainly by way of manual labour in any trade set out in the Sixth Schedule to Part II of the National Insurance Act, 1911 (Unemployed Insurance) who were formerly indentured, whose apprenticeships have been interrupted by war service and who are not covered by decision No. B 2,456 below:—

B. The Umpire has decided that contributions are not payable in respect of:—

2,454. Workmen engaged in filling and completing electric flash lamps.

2,456. Indentured apprentices whose apprenticeships have been interrupted by war service, provided that:—

(*a*) The indentures have been duly stamped and executed, have not expired and are still in force; or

(*b*) The period of the indentures has been formally extended by a duly-executed endorsement on the original document.

Contributions under these decisions are payable as from September 4th, 1916.

The Watt Centenary Celebration.—At Birminghan University, on Tuesday last week, the Lord Mayor, Sir David Brooks, opened the proceedings in celebration of the memory of James Watt, and said that it was proposed to endow a professorship of engineering—the "James Watt Chair"—at the University of Birmingham, for the promotion of research in the principles underlying the production of power; it was also desired that a museum should be erected to contain the relics of Watt, Boulton, and Murdoch. Prof. F. W. Burstall delivered a lecture on "The Rise of Engineering Manufacture," and pointed out the great importance of the work done by Boulton and Watt in starting a system of co-ordinated manufacture. Prof. H. S. Hele-Shaw gave a lecture on "James Watt and Invention," in the course of which he suggested that the James Watt Memorial should be a "Chair of Invention," which would be a unique departure worthy of James Watt and the City of Birmingham.

In the afternoon a memorial service took place at the Parish Church of St. Mary's, Handsworth, where Watts's remains are interred, and Dr. E. W. Barnes, Master of the Temple, delivered an address on Watts's life, and the consequences of his discoveries and inventions. Afterwards the visitors attended a garden party at Heathfield Hall, Watts's former residence.

On Wednesday Sir Oliver Lodge gave a lecture on "Sources of Energy," dwelling on the possibilities of radio-activity, and Prof. J. D. Cormack read a paper by Prof. A. Barr and himself on the model of the Newcomen engine which Watt repaired, at the University of Glasgow. In the afternoon, visits were paid to Watt engines at Ocker Hill, Bordesley, and Lawley Street, and in the evening the Commemoration Dinner was held at the Grand Hotel, the Lord Mayor presiding.

A spectacle, illustrating the advance in engineering science made possible by the genius of James Watt, brought to a close the Centenary Commemoration at Birmingham on Saturday. A long procession, headed by a large size model of a Watt engine, passed through the centre of the city to the Botanical Gardens, Edgbaston, where lectures were delivered by Prof. Burstall and others. The procession was accompanied by a long file of motor lorries on which were mounted exhibits of engineering products.

Electrometallurgy in U.S.A. and France—In an address before the Académie des Sciences, quoted in *Le Génie Civil*, M. M. Altmayer gave an account of a recent investigation of electrometallurgical processes in the United States, which he had carried out with the authority of the French Government. He said that the output of electrolytic copper in the States was estimated at 1,200,000 tons a year. Commenting on the lecture, M. Guillet said that in France the deficiency of lead and zinc was being rapidly made up. The Société de Pevarroya during the war made very great efforts, and established a large lead works near Marseilles; it had now almost settled the erection of a works in the Pyrenees for the conduct of electrolytic processes, which would produce 20,000 tons of zinc a year. As the local ores were mixed, it would be necessary to add to the works a new lead foundry.

Electricity Supply Commercial Association.—A series of mass meetings was held under the auspices of this Association during the week September 8th to 13th. The opening meeting took place at Manchester, on September 8th, Mr. Kingston (Chairman West Yorks. Division) presiding over a large attendance. He was supported by the President of the E.P.E.A., representatives of the West Yorks. and Lancs. Divisions, and the General Secretary of the Association.

The Chairman briefly addressed the meeting, introducing Mr. G. R. Smith, hon. general secretary, who gave full details of the many phases of the Association's work and usefulness. Considering that the Association was only formed in February last, by the amalgamation of the Chief Commercial Officers' Association and the Clerical Assistants' Association, the progress made has been truly remarkable. To enrol nearly 2,000 members in this short period is an accomplishment worthy of note.

From its formation the Hon. General Secretary traced its progress and organisation, detailing the many cases in which individual members benefited materially through its efforts, its work in connection with the Electricity Supply Bill and the question of representation on Industrial Councils, its successful struggle to obtain recognition as the only authority set up to represent exclusively the interests of the commercial and clerical staffs of electricity supply and tramway undertakings, both company and municipal, its work in connection with the new Federation of Technical, Scientific, and Professional Associations, &c.

The President of the E.P.E.A. also addressed the meeting, showing the various ways in which the E.P.E.A. and the Association are working together in common purpose, and touched briefly on the questions of federation and direct affiliation.

Representatives from West Yorks. and Lancashire Divisions gave brief addresses, after which a unanimous pledge of support to the Association was carried with great enthusiasm.

At the West Yorks. meeting, held on September 9th, at Leeds; the Lancashire meeting on September 11th, at Liverpool; and the West Midlands Division on September 13th, at Birmingham, a similar programme was adopted before large attendances. Everywhere the meetings were successful, and were marked with keen enthusiasm.

The crowning effort was at Birmingham, the last of this series, where a concert organised by the West Midland Council was enjoyed, harmony blending successfully with the more serious items on the agenda. The President of the Association was present at this meeting, and delivered an address to the members. The Hon. General Secretary said that the meetings had filled a twofold purpose. Existing members had had many points of interest explained to them, and those proposing to join had had a clear understanding of the work and purpose of the Association. Well over 100 new members had been obtained. The Association believed that it could take a great part in educating, not only its members, but the general public, on the need for developing the electrical industry, and schemes to this end were under consideration. He announced that a further mass meeting would be held in London on October 13th, at Caxton Hall, Westminster, commencing at 7 p.m. Admission would be open to members and all eligible for membership on application, stating the undertaking represented; tickets to be obtained from Mr. J. C. Adams, hon. sec., Greater London Division, 87, Connaught Road, Teddington.

Appointments Vacant.—Shift engineer (82s. 7d.), for the Eccles Corporation Electricity Works; instructor of electrical installation works, for the East Ham Technical College Evening Classes. See "Official Notices" to-day.

A Visit to Switzerland.—Bailie Sadler, and Mr. W. W. Lackie, chief engineer to the Glasgow T.C. electricity department, will leave for Switzerland early in October, for the purpose of visiting the works of Messrs. Brown, Boveri & Co., in various parts of Switzerland, and inspecting a new electrical device on the mercury vapour process for the transformation of alternating current into direct current.

A Ponder's End Strike Ended.—According to newspaper reports a strike of a thousand girls at the Edison Swan works at Ponder's End, who protested against the dismissal of the manager of the lamp department, was settled on Tuesday evening by the reinstatement of that gentleman.

Birmingham Electric Club.—A Snooker Handicap has been arranged amongst the members of the Birmingham and District Electric Club. The games will be played at the Grand Hotel, Colmore Row, Birmingham. Entrance fees (1s.) have to be sent to the hon. secretary, Mr. N. Deykin, 130, Station Road, Wylde Green, Birmingham, by Monday next.

In his paper, read on September 13th, on "High-Efficiency Projector Arcs," Mr. H. F. Steventon gave an account of the pre-war projector, using the pure carbon arc, and of the work of Beck in Germany and Elmer Sperry in New York, with flame carbons. He was present at a series of official trials in Italy, in which a 150-ampere lamp in a 36-in. projector produced a beam of 350,000,000 c.p. Mr. Sperry, with a 200-ampere lamp and a 60-in. projector produced a beam of 1,052,000,000 c.p. The latest form of searchlight was developed in Paris, using only one carbon, the negative electrode being a copper ring through which water was forced for cooling purposes. In the author's opinion, this type of lamp would not compete with the lamps of the Sperry or Beck type, although, probably, having a future for kinema work. He said that the increased range of gunfire and torpedoes, and the advent of aircraft into modern warfare, demand a beam of still greater brilliancy.

Leakage Resistance of Electric Railway Roadbeds.—Technologic paper 127 of the Bureau of Standards, entitled "Leakage Resistance of Electric Railway Roadbeds and its Relation to Electrolysis," by E. R. Shepard, gives the result of more than three years of electrical resistance measurements on different types of roadbeds. The resistance of the roadbed is an important factor in the amount of current which may escape. Short sections of fourteen common types of roadbeds were constructed on the grounds of the Bureau of Standards, and resistance measurements under varying weather conditions were carried on for a period of three years. Some measurements were also made on a number of city lines in and about Washington, both open track and several types of roadbed in paved streets being investigated. Through the co-operation of the United States Forest Products Laboratory at Madison, Wisconsin, measurements were also made on several sections of test track on the Chicago, Milwaukee, and St. Paul railway, where railroad ties subjected to several different kinds of preservatives were employed. The results of these measurements are given in tabular and graphical form, and the following conclusions have been drawn:—

Roadbeds constructed with solid concrete ballast and vitrified brick or other non-porous pavements have a low leakage resistance to earth which is affected only moderately by seasonal and weather changes. There is little difference between wood and steel ties in their effect on the resistance of roadbeds of this kind. Insulation is not of practical value in reducing leakage current from such roadbeds. The resistance of single roadbed of this type is from 0.2 to 0.5 ohm per 1,000 ft., under ordinary conditions, but may be two or three times this when the ballast is frozen to a depth of 1 ft. or more. For double roadbed of this type the resistance is approximately 70 per cent. of that for single roadbed, or the leakage from double track would be about 40 to 50 per cent. greater than from single track.

Roadbeds constructed with a foundation of clean crushed stone under concrete paving base have a much higher resistance than roadbeds with a solid concrete ballast. In the case of the experimental roadbed the ratio was found to be about 3 to 1. Roadbeds with a full crushed stone ballast and a Tarvia finish have a very high leakage resistance which is of the order of 2 to 5 ohms per 1,000 ft. of single track. The leakage from a double roadbed of this type and other high-resistance types is from 80 to 100 per cent. greater. The resistance of earth roadbed in which the ties are imbedded, and therefore kept in moist condition, is much lower than that of open construction roadbed, being from 1 to 1.5 ohms per 1,000 ft. of single track under normal conditions and considerably more when the ground is frozen.

The resistance of roadbeds of open construction is subject to wide variation depending upon the condition of the ties and ballast. In very dry weather with good ballast the resistance will be 10 to 15 ohms or even more per 1,000 ft. of single track, but in wet weather it will drop to from 3 to 5 ohms. Cinder, gravel, and particularly crushed stone, when used as a ballast in open-track construction, produce very high-resistance roadbeds. Earth has a tendency to keep the ties moist, and therefore to increase the leakage. Open-construction track is often considered to be insulated from the earth, but this is not strictly true. Assuming a potential difference between the track and the earth of 5 volts and a leakage resistance of 10 ohms per 1,000 ft. the total leakage per mile would be 2.64 amp. This small leakage current would not ordinarily be harmful to underground structures in the vicinity of the track.

Summer Time Closed.—During the night of September 29th-30th at 2 a.m., we resume normal time, and it will be necessary for us to put our clocks back one hour.

For the information of the many users of "Pulsynetic" clocks, we are informed by the makers that the best method of altering electric clocks of the "Pulsynetic" class is to stop the pendulum of the transmitting clock for one hour; this recommendation also applies to ordinary domestic striking clocks, as in these it is fatal to put the hands backwards. "Pulsynetic" clock systems which include in their circuits public or turret clocks should be altered after dusk on Sunday night, but works and factory systems—of which there is now a large number—can be more conveniently stopped on Saturday after closing time, provided, of course, that a public clock is not connected with the system.

An excellent suggestion in connection with watches—given by an expert watchmaker—is to put the watch quickly back to, say, 7 or 8 minutes beyond the necessary hour, then slowly turn the hands forward to the correct time. When the watch is put back slowly to the correct time, there is a danger of stopping the watch, and if this is not noticed the results may be, to say the least, inconvenient.

Mica-Insulated Coils.—Where the radiation is not sufficient to maintain the relatively low temperatures which were formerly allowed in electrical apparatus it has been necessary in modern designs to provide insulation which will stand high temperatures. For this purpose the Westinghouse E. & M. Co. has developed a 150 deg. C. (292 deg. F.) coil which is suitable for 11,000-volt alternators for hydroelectric service, says the *Electrical World*. The coil consists of two conductors, each composed of six 0.204-in. (0.52-cm.) square bare copper wires in parallel, each wire being painted with "bakelite" and insulated with one layer of mica tape to reduce eddy-current losses. Each conductor is then bound with thin cotton tape (structural material only). This is followed with the application of the conductor insulation, which consists of two layers of mica tape and one layer of thin cotton tape (structural material only). The conductors are next assembled with a reinforcing strip of pure mica between each, the complete coil is bound with thin cotton tape and the straight portions of the coils which are embedded in the slots are treated with bakelite. This operation is followed by placing the straight portions in a special steam-heated and water-cooled press, and pressing them to a predetermined size, rendering that portion subjected to high temperatures solid and unaffected by subsequent treatments and operating temperatures. The coil is then given a vacuum and impregnating process in "hydrolene." After this operation, the application of the mica wrapper on the straight part embedded in the slot, together with the taping of treated cloth tape on the coil end, forms the outside or coil insulation to ground. This wrapping and taping is applied in two operations, the ends of the wrapper being made in a tapered form, permitting a sealed joint between the wrapper and the taping. This junction is also treated with a special cement. The wrapper is first applied to the coil in a sheet form by hand, being drawn around the coil as tightly as possible. The coil is then placed in a special wrapping machine, equipped with electrically heated plates under tension, revolving around the wrapper. This softens the bond and permits the wrapper under the pressure of the revolving plates to slide on itself. The result is an extremely solid and compact insulation. The coils are then removed from the wrapping machine and pressed in a cold press. The taping of varnish-treated cloth is applied over the coil ends, each layer being brushed with a moisture-resisting varnish, and the coil ends and portions of the wrapper projecting beyond the laminations beyond the core are finished by taping with a layer of cotton tape, which is again treated several times in moisture-resisting varnish. The percentage of mica in the wrapper is about 60 per cent., and can be increased to approximately 80 per cent. by inserting additional sheets of hand-built mica between the turns of the micarta folium wrapper.

International Electrotechnical Commission.—A plenary meeting of the International Electrotechnical Commission will be held in London on October 20th, 21st, 22nd, and 23rd. This is the first plenary meeting since the outbreak of war, and important questions in regard to the future work of the Commission will come forward for decision. It is confidently expected that 40 to 50 delegates will be present representing 16 to 18 countries.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. D. MCLENNAN has been appointed manager of the Alloa Corporation electricity works at £500 per annum. There were 120 applicants.

General.—MR. ERNEST B. BARRLOW, A.M.I.E.E., resident engineer and manager of the Urban Electricity Supply Co.'s generating station at Berwick-upon-Tweed, has been presented by the employés, on the occasion of his marriage, with a marble time-piece and fountain-pen.

LIEUTENANT AND ACTING CAPTAIN J. W. LAW, Glamorgan Fortress Engineers (Electric Lights Company), has relinquished his acting rank, with effect from the 16th ult. Lieutenant Law was commissioned in the corps shortly after the war broke out, and he got his acting captaincy in March, 1915. Apparently it will be some time before the regimental lists of the various electric lights companies, attached to Fortress Engineers of the Territorial Force, will be published in the "Army List." For the first few months of the war the lists were published under the heading of the unit to which they belonged, but after the middle of 1915 the practice ceased, because, perhaps, it might have given some clue to the locality of the units concerned. The only corps shown separately were the London Electrical Engineers and the Tyne Electrical Engineers. Officers of Electrical Companies are still shown under a general list of precedence—captains, lieutenants, and second-lieutenants. The current list shows 55 captains, 246 lieutenants, and 12 second-lieutenants on probation.

Roll of Honour.—MR. PHILLIP PERRY, late of the Duke of Cornwall's Light Infantry, who was previously on the staff of the Cornwall Electric Co., has died of malarial fever contracted in Egypt.

Obituary.—E. B. JONES.—The death is announced, in the *Industrial Australian*, of Mr. Edwin B. Jones, second Commissioner of the Victorian State Railways, aged 50 years, from pneumonic influenza. Mr. Jones was appointed Secretary for Railways in 1911, and Commissioner in 1915. While acting as secretary he was deputed by the Commissioners to take charge of the arrangements necessary for the introduction of electric traction on the suburban railways, and in this connection he investigated the electrification systems of America and Europe in 1914. In 1916 he visited England, and in conjunction with the Victorian Agent-General and Mr. Merz successfully adjusted several matters relating to contracts for equipment for the suburban railways electrification, and was able to secure a large amount of necessary material which otherwise would not have been obtainable until some time after the conclusion of the war.

THEODORE P. SHONTS.—*The Times* publishes from New York a report of the death which occurred on September 21st, of Mr. Theodore P. Shonts, who controlled large railway and financial interests. Mr. Shonts was since 1907 President of the Interborough Consolidated Corporation, which controlled the greater part of the various subways (tubes), elevated electric railways, and tramcar lines in New York City.

Will.—The late MR. J. B. CONCANNON, of the Anglo-Argentine and Brisbane Tramway Companies, left £133,700 gross and £126,392 net personalty.

NEW COMPANIES REGISTERED.

Power Equipment Co., Ltd. (158,743).—Private company. Registered September 12th. Capital, £6,000 in £1 shares. To take over the business of electrical and mechanical engineers carried on by J. Cruwys and J. P. Keith at Crown Works, Cricklewood. The subscribers (each with one share) are: J. Cruwys, 41, Fordwych Road, Brondesbury, N.W.2, electrical engineer; J. P. Keith, 58, London Road, Wembley, Middlesex, engineer. The first directors are: J. Cruwys and J. P. Keith (both permanent, subject to holding £500 shares each). Secretary: J. Cruwys. Registered office: Crown Works, Cricklewood, N.W.2.

Insulators, Ltd. (158,740).—Registered September 12th. Capital, £75,000 in £1 shares. Objects: To carry on the business of manufacturers of insulating and chemical materials and products, constructors of and dealers in plant, apparatus and compounds used in the installation of cold storage premises, buildings, ships, sheds, vehicles or railroad rolling stock, &c. The subscribers (each with one share) are: A. N. Stockdale, 20, Lawrence Lane, E.C., secretary; N. G. Prince, 83, Priory Road, Hampstead, N.W., merchant; a shorthand typist and four clerks. Minimum cash subscription, seven shares. The subscribers are to appoint the first directors. No share qualification required. Remuneration, £250 each per annum (£50 extra for the chairman). Solicitor: R. S. Smallman, 8, Queen Street, E.C.

Ebo Rubber, Ltd. (158,751).—Private company. Registered September 12th. Capital, £3,000 in £1 shares. To carry on the business of india-rubber manufacturers, manufacturers of and dealers in all articles made or prepared with or from india-rubber, cable makers, &c. The subscribers (each with one share) are: G. Cowap, Doe Bank, Colne Road, Winchmore Hill, N.21, engineer; J. Noene, 16, Duneto Road, Goodmayes, electric cable maker. The first directors are: G. Cowap (managing director), J. Noene and W. A. Cox. Registered office: "A" Warehouse, 3rd Section Seal Wharf, Stratford, E.

Patex, Ltd. (158,653).—Private company. Registered September 9th. Capital, £100 in 1s. shares. To carry on the business of patent experts, electrical, mechanical, constructional and general engineers and contractors, scientific instrument makers and dealers, &c., and to enter into an agreement with A. E. Coyne and A. C. Hunt. The subscribers (each with one share) are: A. E. Coyne, 117, Rustlings Road, Sheffield, engineer; A. C. Hunt, 51, Linden Road, Bourneville, architect; C. A. Jones, 25, Whiteley Wood Road, Sheffield, director of limited company; J. J. Jubb, 151-7, Fitzwilliam Street, Sheffield, accountant. Table "A" mainly applies. J. J. Jubb signs as "director." Registered office: Albert Buildings, 151-7, Fitzwilliam Street, Sheffield.

Metal Deposition, Ltd. (158,857).—Private company. Registered September 17th. Capital, £5,000 in 4,000 preference shares of £1 each and 20,000 deferred ordinary shares of 1s. each. To acquire, exploit and turn to account any process for the deposition of metal on aluminium or other substances, &c. The subscribers (each with one deferred ordinary share) are: G. H. Glover, 187, Camberwell New Road, S.E.5, incorporated secretary; W. H. Butler, Clyde Villa, Bridge Road, Hammersmith, W.6, stockbroker. The first directors are not named. Secretary: G. H. Glover. Registered office: 32, Charing Cross, Whitehall, S.W.1.

Grimsby Electric Welding Co., Ltd. (158,854).—Private company. Registered September 17th. Capital, £5,000 in £1 shares. Objects: To carry on the business of electric welders, engineers, ship builders, aircraft and motor manufacturers, &c. The subscribers (each with one share) are: H. Blanchard, Marten, Weelsby Road, Grimsby, marine engineer; C. A. Osborne, Albemarle House, Mill Road, Cleethorpes, trawler owner. The first directors are: H. Blanchard (managing director), C. A. Osborne and W. H. Coggon. Registered office: Humber Bank, Fish Docks, Grimsby.

Provincial Wireless Colleges, Ltd. (158,778).—Private company. Registered September 13th. Capital, £200 in £1 shares. To carry on a school or schools for the teaching of inland, cable and wireless telegraphy and telephony, and general electrical and specific wireless telegraph and telephone technology, with all practical work appertaining to those subjects; also to carry on the business of publishers and sellers of technical papers and books, &c. The subscribers (each with one share) are: H. A. Flick, 45, Ashley Road, N.19, lecturer, author and general instructor on telegraphy; F. Davies, "Woodbank," Corwen, N. Wales, lecturer and general instructor on telegraphy. The first directors are: H. A. Flick and F. Davies (both permanent). Registered office: 39, St. Giles Street, Norwich.

James Kilpatrick & Son, Ltd. (10,625).—Private company. Registered in Edinburgh, September 12th. Capital, £15,000 in 5,000 7 per cent. cumulative preference and 10,000 ordinary shares of £1 each. To acquire the business of electrical and general engineers, contractors, workers in iron, steel, copper, brass and lead, &c., carried on by J. Kilpatrick and W. R. Scott, under the style of "James Kilpatrick & Son," at Terrace Buildings, Paisley. The subscribers (each with one share) are: J. Kilpatrick, Inchdene, Greenlaw Drive, Paisley, electrical engineer; W. R. Scott, Invermanse, Southfield Avenue, Paisley, electrical engineer; T. White, Hillside, Thornley Park, Paisley, engineer; B. J. Thomson, 4, South Park Drive, Paisley, electrical engineer; William Mackean, Ltd. (per R. Gilchrist), Caledonia Street, Paisley, starch manufacturers; J. Robertson, Roncil, Paisley, preserve manufacturer; E. D. Anderson, Ellonville, Hawkhead Road, Paisley, solicitor. The first directors are: W. R. Scott, J. Kilpatrick and T. White. Secretary: J. Winning. Solicitor: E. D. Anderson, 90, High Street, Paisley.

Stockwell & Ohms, Ltd. (158,844).—Private company. Registered September 16th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical machines, instruments and accessories, mechanical and electrical engineers, &c. The subscribers (each with one share) are: E. Mepsted, 32, Rodney Street, Pentonville Road, N.1, engineer; L. P. Hayward, Ashdown, Radlett Road, Boreham Wood, Herts, engineer. The first directors are not named. Qualification, £100. Secretary: H. Holmes. Registered office: 32, Rodney Street, Pentonville, N.1.

Pleno, Ltd. (158,777).—Private company. Registered September 13th. Capital, £100,000 in £1 shares. To acquire any interests in patents, &c., relating to the effecting of economy in the manufacture, distribution and application of gas in connection with solid, liquid and gaseous fuel, and to carry on the business of general gas engineers and contractors, electricians, electrical engineers, manufacturers and suppliers of manufacturing and distributing gas plants, &c. The subscribers (each with one share) are: F. C. Caldicott, 3, Warwick Avenue, Coventry, merchant; G. Helps, Manor Court, Nuneaton, civil engineer. The first directors are: F. C. Caldicott and G. Helps. Secretary: A. S. Clark. Registered office: Queen's Buildings, Queen's Road, Nuneaton.

Metropolitan-Vickers Electrical Export Co., Ltd. (158,935).—Private company. Registered September 19th. Capital, £100,000 in £1 shares. To carry on the business of dealers in and exporters of electrical plant and machinery, &c. Power is taken to construct, lay down and maintain telegraphs, telephones, marine, cables, &c. The subscribers (each with one share) are: E. Fitzjohn Oldham, 51, Lincoln's Inn Fields, W.C., solicitor; S. E. Cash, 51, Lincoln's Inn Fields, W.C.; solicitor. The first directors are: Sir Edmund W. Smith, John E. Hutton, Harold Lloyd and Robert S. Hilton. No qualification required. Solicitors: Vizard, Oldham, Crowder and Cash, 51, Lincoln's Inn Fields, W.C. Registered office: 2, Norfolk Street, Strand, W.C.2.

Ward & Goldstone, Ltd. (158,256).—Registered September 19th. Capital, £200,000 in £1 shares (100,000 preference). To take over the business of engineers carried on by J. H. Ward, M. H. Goldstone, A. A. Goldstone and L. B. Goldstone at Sampson Works, St. Simon Street, Salford, as "Ward & Goldstone." Minimum cash subscription 25 per cent. of any shares offered to the public. The first directors are: J. H. Ward, Mayfield, Alexandra Road, S. Manchester, electrical engineer; M. H. Goldstone, Glenavon, Queen's Road, Southport, electrical engineer; A. A. Goldstone, Laurel House, Laurel Grove, Withington, Manchester, electrical engineer; L. E. Goldstone, 70, Palatine Road, Withington, Manchester, electrical engineer. Solicitor: G. P. Haworth, 19, Chapel Walks, Manchester. Secretary: A. Lowe. Registered office: Sampson Works, St. Simon Street, Salford.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Wm. Wadsworth & Sons, Ltd.—Mortgage on land and premises at Bolton, and the company's other assets, except uncalled capital, dated July 31st, 1919, to secure all moneys becoming due from company to Manchester and Liverpool District Bank.

C. A. Vandervell & Co., Ltd.—Particulars of £300,000 debentures authorised July 17th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital and secured by trust deed specifically charging certain freeholds, leaseholds, plant, &c. The whole amount is now issued. Trustees: National Provincial Bank of England.

CITY NOTES.

The Victoria Falls and Transvaal Power Co., Ltd.

The annual general meeting of this company was held on Friday last at Salisbury House, E.C. The Marquis of Winchester, who presided, said that the shareholders were to be congratulated on the continued success of the business. Notwithstanding the increase in cost of all classes of material, wages and freights, the African revenue showed improvement, and in spite of the increase in taxation, the year's trading had enabled the company to maintain the same dividends and addition to reserve fund as for last year, with a carry forward of practically the same amount to the current year. The share capital stood at the same figure as in previous balance sheets. The figure covering the first mortgage debentures was £3,018,501. The actual amount outstanding was £2,550,000, but they had added the amount of the debentures drawn for redemption which up to the date of the balance sheet had not been presented for payment. The second mortgage debentures remained at the same figure, namely, £1,376,640, the purchases in the market in previous years having been sufficient to cover the amount to be redeemed during the year covered by the accounts. The creditors and credit balances, which included provision for payment of taxes, debenture interest, &c., amounted to £1,226,485. The reserve fund had been increased by a further £50,000 and now stood at £250,000. On the asset side of the balance sheet the leases and concessions and the various undertakings purchased at the time of the formation of the company stood at £1,466,325, and the company's power stations, buildings, equipment and land at £1,911,160. He might mention that at the prices which were ruling to-day similar machinery could not be installed at the prices paid for the existing installations. The company's loan to the Rand Mines Power Supply Co., Ltd., and the 500,000 shares in that company stood together at £2,981,530, and the advances were secured by a first charge over the company's whole undertaking. Turning to the profit and loss account, the revenue from power and lighting amounted to £860,172, showing an increase of £31,919 over last year's revenue. The amount received for interest and registration fees in London during the year amounted to £43,608, a sum of £2,512 less. On the debit side of the account the expenses of administration were practically the same as last year. The amount paid for the service of the debentures in the shape of interest, premium, and expenses amounted to £229,715. Depreciation and amounts written off, and provision for British taxation, appears in the account at £410,844, as compared with £337,261 last year, the increase of £73,583 representing the additional provision for taxation. The net result for the year was a profit of £224,128, which had been carried to the balance sheet and added to the amount brought forward from the previous year, giving a total balance to the credit of the profit and loss account of £321,819. Of that sum they had transferred to the reserve fund a further £50,000, leaving £271,819 to be dealt with. In respect of the balance the preference shareholders had received three dividends, two each of 3 per cent. and one of 4 per cent., all less income tax, and the ordinary shareholders had received a dividend of 5 per cent. less income tax. These dividends absorbed £178,125, leaving a balance remaining of £93,693 which had been carried forward to the current year. With regard to the relief to be obtained from British income tax in respect of Colonial taxation, he regretted that they had not yet been able to come to a satisfactory settlement with the Inland Revenue authorities. The claim for the fiscal years 1916-17 and 1917-18 had now been before the authorities for over a year, and although they had endeavoured to proceed with the matter the authorities were apparently unable to deal with the claim until other questions which they had open with them had been disposed of. Those had now been dealt with, and they were doing all they could to come to an early settlement. Next year they would deal with the question of the renewal of the earlier group of contracts which were negotiated for a period of twelve years with the option of renewal on the same terms for five years. They approached that matter with the great advantage that during the years which had elapsed since the commencement of supply the regularity and convenience of the electrical drive had been thoroughly tested and not found wanting. A further reason in favour of power supply from central stations, was that in the future the cost of raising capital was not likely to fall much for many years and the cost of new plant was not likely to gravitate towards cheapness, seeing the high rate of labour in all classes both skilled and unskilled. As they were aware, their consumers had an interest in their prosperity through a participation in the revenue after all outgoings and certain charges on capital hitherto not covered had been allowed for, and that would in future operate as a reduction in the price of power. Having expressed the hope that some means would be found to avoid the closing of the low grade mines in South Africa, and referred to the services of the staff in the war, his lordship concluded by paying a tribute to the good work done by Major Bagot, the general manager, Mr. Bernard Price, the chief engineer, and the staff generally in South Africa.

Mr. A. E. Hadley seconded the motion.

Replying to Mr. W. C. Clark, a shareholder, the Chairman said it was not possible to sell their war loans and use the amount for reducing the debenture debt. It was true that the debentures could be paid off at six months' notice, but the premium was 10 and at the present moment the board would not be justified in taking any such step, as there was a possibility that the debentures might come back from Germany through the Board of Trade. They were issued to the German banks because at the time no British bank or any British investors would look at them.

The report was adopted.

Constantinople Telephone Co.

The Financial Times states that shareholders have been called together for November 4th to receive a report on the condition and prospects of this company. No accounts have been published since those down to December, 1913, owing to the officials of the company being compelled to leave Turkey early in 1915, before the accounts for 1914 could be completed. Shareholders will be asked to appoint two directors in place of the late Sir George Franklin and the late Mr. David Smith. They will also be asked to ratify the acts of the directors since the last annual meeting.

The system was taken over by the Turkish Government in 1915, but after the armistice the general manager and expert staff of the company regained possession on December 2nd, 1918. The company proposes that the receipts and expenditure during the working of the system by the Turkish Government from March 15th, 1915, to April 1st, 1919, should be for the account of that Government, with the obligation on its part to pay to the company an indemnity which will put it in a position to pay interest to the bondholders and shareholders in respect of the said period. The necessary claims in this respect have been laid before the competent authorities, and it is hoped that they will receive an equitable settlement. The funds available in London since the period of the last report and accounts have been utilised for the supply of materials for repairs, renewals, and additions to the system and other urgent expenditure necessary to conserve the interests of the company. The assets in London at the present time consists of: Cash at bank and on deposit, £6,421; investments in War Loans, at cost, £27,795; against which there are outstanding liabilities in respect of services rendered or materials supplied and work done by contractors prior to the war, the exact amount of which it has been impossible to ascertain at the date of this report, but which, so far as can be estimated, exceeds £60,000. In addition to

these liabilities, the accrued interest on the 6 per cent. obligations to July 1st, 1919, amounts to £60,000, a sum which, as mentioned above, forms part of the claims formulated by the company against the Ottoman Government. The general manager is of opinion that the revenue now being received in Constantinople will be more than sufficient to meet the local expenditure.

John Brown & Co., Ltd.—In their report for the year ended March 31st, 1919, the directors state that on the cessation of hostilities arrangements were made for the exchange of the shares held by the company in the Coventry Ordnance Works for an equal number of shares in the English Electric Co., and these works will, in a great measure, be devoted to the construction of main generating and other electric power plant. The works, however, will remain available for ordnance manufacture as and when required. In addition to the Coventry Ordnance Works the English Electric Co. comprises Dick, Kerr & Co., the Phœnix Dynamo Co., Willans & Robinson, and other companies concerned in electrical productions. Sir Charles Ellis has accepted the chairmanship of the company, and Colonel Bernard A. Firth and Mr. John Sampson are also members of the board.

Crossley Bros., Ltd.—It is proposed to increase the nominal capital of this company to £2,000,000. Further extensions of the Heaton Chapel works are essential to keep pace with the demands of the business. The directors have purchased the whole of the shares of the Premier Gas Engine Co., Ltd., of Nottingham, and a substantial interest in a Bedford tractor company. The directors of Crossley Bros. propose to capitalise £190,104 of the undivided profits and to issue a corresponding amount of £1 ordinary shares, giving each ordinary shareholder one for every three held.

Nairobi Electric Power & Lighting Co., Ltd.—The report for 1918 gives the share capital at £34,160 issued. Debentures have been repaid leaving £15,000 still outstanding. Dividends have again been paid amounting to 10 per cent. for the year, less income tax.

	1917.	1918.
Units generated by water power	1,458,091	779,082
Units generated by steam power	179,899	369,991
	1,637,990	1,149,073
Motors connected, B.H.P.	693	677
Lights connected, 40-watts equiv.	(corrected) 13,833	14,675

Direct West India Cable Co., Ltd.—Net result of working for year ended June, 1919, is a balance of £14,074, against £15,225 for the previous year. After paying 6 per cent. free of tax, for the year, £11,374 is to be carried forward. The cables have worked efficiently during the year, but the insulation of the Bermuda-Turks Island section remains low. Mr. R. J. Hughes has been elected a director to fill the vacancy created by the death of Mr. Fred Ward.

Halifax & Bermudas Cable Co., Ltd.—The net result of working for the year ended June, 1919, is a balance of £26,628, against £9,697 for the previous year. After paying 6 per cent., free of tax, £23,628 is to be carried forward. The company's cable was repaired on November 3rd, 1918, and worked efficiently until June 21st, 1919, when it was again interrupted; it was repaired on July 22nd, 1919. Mr. R. J. Hughes has been elected a director to fill the vacancy created by the death of Mr. Fred Ward.

Marconi Wireless Telegraph Co. of Canada.—At the general meeting, held in Montreal, on September 17th, it was agreed that the capital be reduced from $5,000,000 to $3,750,000 by reducing the par value of the issued shares from $5 to $2.50, and authorising the issue of 500,000 additional shares of $2.50 each, and that the directors of the company be authorised to issue all or any part of the said 500,000 additional shares as they may deem advisable for carrying on the business.

Schmidt Superheating Co. (1910), Ltd.—The Public Trustee is inviting tenders for the purchase of 30,000 "A" ordinary shares of £1 each, fully-paid, in this company, vested in him as custodian by an order made by the Board of Trade under the Trading with the Enemy Amendment Act, 1916. Tenders have to be delivered by September 27th.

Shawinigan Water & Power Co.—Dividend of 1¾ per cent., or at the rate of 7 per cent. per annum on the common stock, for the September quarter.

Manila Electric Railroad & Lighting Corporation.—Dividend of 1½ per cent. for the September quarter on the common stock.

Bromley (Kent) Electric Light & Power Co., Ltd.—The directors announce that no interim dividend will be paid this year.

International Light & Power Co.—Dividend of 1¾ per cent., less British income tax, on the preference shares for the quarter ended September.

Mackay Companies.—Dividend of 1½ per cent. ($1½ per share), less income tax, on common stock for quarter.

Stock Exchange Notice.—Application has been made to the committee to allow the following to be quoted in the Official List:—

London United Tramways, Ltd.—2,625,000 ordinary shares of 5s. each, fully-paid, Nos. 1 to 2,625,000, and 962,841 5 per cent. preference shares of £1 each, fully-paid, Nos. 1 to 962,841.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less tax, on the preference stock for the quarter, and a second quarterly interim dividend of 1½ per cent., free of tax, on the ordinary stock.

Direct Spanish Telegraph Co., Ltd.—Dividend at the rate of 10 per cent. per annum on the preference shares, and an interim dividend at the rate of 4 per cent. per annum, free of income tax, on the ordinary shares, both for the June half-year.

Eastern Extension, &c., Telegraph Co., Ltd.—Interim dividend for the quarter ended June of 3s. per share, free of tax.

STOCKS AND SHARES.

Tuesday Evening.

The weakness of British Government securities casts something of a damper over investment stocks at large. From the way in which the public are selling their gilt-edged investments, it is manifest enough that the demand, temporarily at any rate, is for more speculative stocks and shares. "The sweet simplicity of Consols consoles" no longer, and the public say that they cannot afford to take 5 per cent. on their money, considering the dearness of everything else. This has its effect upon investment markets, such as those with which we mainly deal, and the tendency has been to let prices sag.

Home Railway stocks dropped to a level at which they attracted a little purchasing, but this did not suffice to save further sales, and the buyers found that they could get all they wanted without bidding enhanced prices. The Underground group is heavy. Metropolitans have gone back a point to 24. The £10 shares of the Underground Electric Railways have given way to 3. The company advertises on its stations that new trains are being built, more and bigger 'buses provided, but the daily traveller on the District line, as well as on some of the other Tubes, wonders how it can be possible so to increase the service as to meet the demands made upon it. All this, however, has little or no effect, so far as can be seen, upon net receipts, and therefore the stocks are left to languish without investment support.

The Constantinople Telephone Co. has issued an extremely interesting letter to the shareholders, in which the directors state that they feel the earliest opportunity should be taken of summoning a meeting of the shareholders. In accordance with the requirements of the articles, this meeting must be held in Constantinople, and it is convened for November 4th next. The company proposes that the receipts and expenditure during the working of the system by the Turkish Government from March 15th, 1915, to April 1st, 1919, should be for the account of that Government, with the obligation on its part to pay to the company an indemnity which will put it in a position to pay interest to the bondholders and shareholders in respect of the said period. The necessary claims in this respect have been laid before the competent authorities, and it is hoped that they will receive an equitable settlement.

Cable securities are going ahead. Rises have occurred in Eastern Extensions, Westerns, Globe ordinary and preference, and the market throughout is a strong one. Jobbers admit that they have very little stock with which to supply the buyers, and it is therefore easier to get a good price as a seller than it is to deal satisfactorily as a buyer. The recent dulness that overhung the market, as a result of what might happen under post-war conditions of aeroplane competition, is passing away, and, as we ventured to point out at that time, it is now recognised that plenty of scope exists for all classes of cable business.

Marconis have fallen away to 5 3-16, and there seems to be no staying power in the market for the time being. It is still said that Italian shares are coming out, which is not unlikely, having regard to the position of exchange between this country and Rome. Foreigners abroad who sell their stock are paid in British currency, which, of course, commands a high premium abroad. To this reason may be attributed the weakness of Brazilian Tractions, which have fallen 2¼ to 58 on account of sales from France and Belgium, where the shares are widely distributed. The recent favourable effect produced by the report has worn off, but, of course, it is likely to tell again as soon as the stream of realisations comes to an end.

Home electricity shares are a rather better market, on account of the attention which has been called to the cheapness of the leading issues. Whereas a week or two ago it was difficult to sell shares at all, there is now a firmer appearance about the market and a little actual buying. This has raised City of London ordinary to 11¼ and the preference to 9⅞, while a fair number of Charing Cross shares, Westminsters and others changed hands this week. On the other hand, London Electric preference weakened to 3½, at which

the yield on the money is over 8½ per cent. The manufacturing group is quiet. British Westinghouse preference have risen 1-16 to 3⅜. The company announces that it will henceforth be known and carry on business as the Metropolitan-Vickers Electric Co., Ltd. A good deal of business is going on in the ordinary shares on the basis of 35s. Siemens were run up to 29s. 6d., but came back to 27s. 9d. Unusual activity developed. Rumours were woven around amalgamation possibilities. A lot of shares came out on the advance.

Babcock & Wilcox fell back to 3½, on the iron strike in the North, which had the effect of causing slight declines in shares of various other engineering and kindred companies. The armament group is quiet. Vickers are a little lower at 34s. 9d., but interest in this group has shrunk to a low ebb. The same remark covers the rubber share market, where the failure of the produce to continue its improvement led to a cessation of demand, and a general falling off in the values of the shares which were run up over-rapidly a fortnight ago. A mining sensation in the case of Hampton Properties, where the price has risen from threepence to two guineas in about a month, caused some inquiries for Kalgoorlie Electric preference, the price hardening to 4s.

Rio Tramways first mortgage bonds have eased off to 91½, and the Mexican group is weak, with Mexico Tramway common shares 2½ down at 37½. Para Electric Railways fell to 3⅜, and the preference to 4, although, on the other hand, Anglo-Argentine Tramways 5 per cent. debenture stock braced up to 64½. Calcutta Trams at 8½ are ¼ down. The preference keep steady at 3⅜. British Electric Tractions have not changed hands for some ten days, when a bargain was done at 41. Underwriting arrangements have been in progress in connection with an issue of £120,000 7 per cent. non-cumulative preference (convertible) shares in the Indian Electric Supply and Traction Co., Ltd.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Sep. 23, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies					
Brompton Ordinary	10	8	6	—	£6 13 4
Charing Cross Ordinary	4	4	2⅜	—	7 5 6
do. do. do. 4½ Pref.	4½	4½	3	—	7 10 0
Chelsea	5	5	3	—	5 0 0
City of London	8	8	11½	+ ⅛	6 19 2
do. do. 6 per cent. Pref.	6	6	9⅜	+ ⅛	6 8 0
County of London	7	7	9½	—	7 11 5
do. do. 6 per cent. Pref.	6	6	9½	—	6 9 9
Kensington Ordinary	7	6	5	—	6 0 0
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	5	6	8½	— ⅛	8 11 6
Metropolitan	4	5	3	—	8 6 8
do. 4½ per cent. Pref.	4½	4½	3⅝	—	7 1 2
St. James' and Pall Mall	9	10	6½	—	8 3 4
South London	5	5	2½	—	7 8 6
South Metropolitan Pref.	7	7	1	—	7 0 0
Westminster Ordinary	9	8	5	—	8 0 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	8	8	96	—	6 5 0
do. Def.	1½	33/8	22½	—	7 9 0
Chile Telephone	8	8	6⅞	—	5 18 6
Cuba Sub. Ord.	7	7	10½	—	*8 13 4
Eastern Extension	8	8	18⅜	+ ⅜	*5 2 5
Eastern Tel. Ord.	8	8	159½	—	*5 0 4
Globe Tel. and T. Ord.	7	8	15⅜	+ ⅛	*5 4 0
do. do. Pref.	6	6	10½	+ ⅛	5 17 1
Great Northern Tel.	23	23	28½	—	7 14 5
Indo-European	13	13	47½	—	6 16 10
Marconi	20	25	5⅛	—	4 16 6
Oriental Telephone Ord.	15	10	2½	—	4 9 9
United R. Plate Tel.	8	8	7⅝	—	*5 1 7
West India and Panama	1/3	1/3	1⅛	—	*4 16 3
Western Telegraph	8	8	16⅜	+ ⅛	*4 17 9
Home Rails.					
Central London Ord. Assented	4	4	£0½	—	8 13 1
Metropolitan	1	1½	24	—1	5 4 2
do. District	Nil	Nil	21¼	—	Nil
Underground Electric Ordinary	Nil	Nil	8	— ⅛	Nil
do. do. "A"	Nil	Nil	8/8	—	Nil
do. do. Income	4	5	93¼xd	—	*5 7 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½	—	8 13 4
Anglo-Arg. Trams. First Pref.	8½	Nil	3	—	—
do. do. 2nd Pref.	—	—	2⅜	—	—
do. do. 5 Deb.	5	5	64½	+1	7 15 0
Brazil Tractions	—	—	58	—2½	—
Bombay Electric Pref.	6	6	12½	—	4 18 0
British Columbia Elec. Rly. Pfce.	5	5	55⅜	—	9 1 10
do. do. Preferred	Nil	2½	4⅝	—	5 7 8
do. do. Deferred	Nil	Nil	39⅜	—	Nil
do. do. Deb.	4½	4½	64½	—	7 16 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	55	—	Nil
do. 6 per cent. Bonds	Nil	Nil	45½	—	Nil
Mexican Light Common	Nil	Nil	32½	—	Nil
do. Pref.	Nil	Nil	48⅜	—	Nil
do. 1st Bonds	Nil	Nil	£0⅛	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3¼	— ⅛	*4 5 9
British Aluminium Ord.	10	10	1⅛	—	5 18 4
British Insulated Ord.	25	12½	2⅛	—	6 1 0
British Westinghouse Pref.	7½	8	3⅜	+ 1/16	4 14 8
Callenders	25	25	8½	— ⅛	7 11 10
do. 6½ Pref.	5	6½	5⅜	—	6 3 10
Castner-Kellner	25	20	2⅞	—	8 0 0
Crompton Ord.	7	10	21/6	—	9 6 0
Edison-Swan, "A"	—	—	1½	—	6 0 0
do. do. 5 per cent. Deb.	4	5	81½	—	6 2 9
Electric Construction	10	10	1⅛	—	8 18 0
Gen. Elec. Pref.	6	6½	1	—	6 10 0
do. Ord.	10	10	2	—	*5 0 0
Henley	25	25	2½	—	6 8 0
do. 4½ Pref.	4½	4½	3⅝	—	6 4 2
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.	—	10	27/9	—	*7 5 0
Telegraph Con.	20	20	26	—	*4 17 9

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, September 23rd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/8	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	,,	£78	..
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£39	..
a Copper Sulphate	,,	£42	..
a Potash, Chlorate	per lb.	1/1	..
a ,, Perchlorate	,,	1/8	..
a Shellac	per cwt.	£24 10	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	,,	£28	..
a ,, Lump	,,	£20	..
a Soda, Chlorate	per lb.	8d.	..
a ,, Crystals	per ton	£30	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£88 to £292	..
b Brass (rolled metal 2/3 to 1/3 basis)	per lb.	1/1½	..
c ,, Tubes (solid drawn)	,,	1/0½	..
c ,, Wire, basis	,,	1/2	..
c Copper Tubes (solid drawn)	,,	1/7½	..
g ,, Bars (best selected)	per ton	£116	..
g ,, Sheet	,,	£146	..
g ,, Rod	,,	£146	..
d ,, (Electrolytic) Bars	,,	£130	..
d ,, ,, Sheets	,,	£154	..
d ,, ,, Wire Rods	,,	£128	..
d ,, ,, H.C. Wire	per lb.	1/4½	..
f Ebonite Rod	,,	1/-	..
,, Sheet	,,	1/6	..
,,	,,	2/6	..
n German Silver Wire	,,	10/- to 11/-	..
h Gutta-percha, fine	,,	2/6½	..
h India-rubber, Para fine	,,	Buyers	..
i Iron Pig (Cleveland warrants)	per ton	£63	..
f ,, Wire, galv. No. 8, P.O. qual.	,,	£20 15	10/- inc.
g Lead, English Pig	,,	£24 to £24 10	..
g Mercury	per bot.	9l. 5s. 6d.	..
e Mica (in original cases) small	per lb.	5/- to 10/-	..
e ,, ,, medium	,,	12/6 to 25/- & up.	..
e ,, ,, large	,,	1/5½ to 1/7½	..
g Phosphor Bronze, plain castings	,,	2/- to 2/4	..
g ,, ,, rolled bars & rods	,,	2/1 to 2/6	..
g ,, ,, rolled strip & sheet	,,	1/9	..
m Silicium Bronze Wire	per lb.	4/3	..
r Steel, Magnet, in bars	per ton	£274 to £275	£5 dec.
g Tin, Block (English)	,,	£4/3	..
n ,, Wire, Nos. 1 to 16	per lb.	White Anti-friction Metals	..
White Anti-friction Metals	per ton	£60 to £292	..

Quotations supplied by—

a G. Boor & Co.
b Thos. Bolton & Sons, Ltd.
c Frederick Smith & Co.
d F. Wiggins & Sons.
e India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
f James & Shakespears.
g Edward Till & Co.
h Boning & Lowe.
i Richard Johnson & Nephew, Ltd.
n F. Ormiston & Sons.
r W. F. Dennis & Co.

Electric Traction in the U.S.A.—The power demand for the electrical operation of the steam railways in the United States in 1914 would amount to 37,200 million units per annum, and would require 40 million tons of coal. The coal equivalent of the coal and oil actually burned as fuel was 140 million tons, so that the electrification would achieve the saving of 100 million tons per annum. According to the *General Electric Review*, on locomotives for freight and slow-speed passenger service it is probable that geared motors mounted directly on the axle will be continued; for high-speed passenger work the motors would be preferably of gearless design. The collection of current presents no great difficulties, and tests show that no arcing is produced when collecting 3,000 amps. at 30 miles an hour, or even up to 60 miles an hour.

The Manufacturers Railway System in St. Louis (Mo.), a private terminal railway with about 24 miles of track, handling 60,000 freight cars annually, is being electrified throughout. The electric locomotives, which are smaller than the steam locomotives formerly employed, weigh 83 tons each, and are capable of hauling a 1,600-ton train (40 loaded cars) at 15 miles per hour. The cost of the change will be $200,000 for the poles, trolleys, &c., and $300,000 for six locomotives.

The *Electric Railway Journal* for May 3rd last publishes a table in which the 1912 and 1917 census statistics for electric railways in the United States are divided on a geographical basis. The largest growth in single track, cars and power output was in the West-North-Central and West-South-Central sections. Wages generally increased more rapidly than employés, to the last degree in the Mountain section. The passenger gains were heavier in the East than in the West; the car-miles heavier in the West than in the East. In all sections, the operating expenses increased faster than the gross income, and in the West and the South this was true of income deductions. The best financial results were obtained by the South Atlantic States, and the worst by the New England, Mountain, and Pacific groups.

Exports and Imports of Electrical Goods during May, June, July, and August, 1919.

The official returns of electrical business for the four months of May, June, July, and August, 1919, show considerably increased export values as compared with the previous four months, the figures for electrical exports showing an increase of £1,173,555 for the period under review. The totals are as follows:—May, £571,824; June, £618,115; July, £727,041; August, £872,649; total, £2,789,629; as compared with—January, £390,210; February, £326,658; March, £420,452; and April, £478,754; a total of £1,616,074.

For comparison we give the figures for electrical exports for the first eight months of 1917, 1918, and 1919:—

January to August, 1917.	January to August, 1918.	January to August, 1919.
£3,158,594	£2,102,671	£4,405,703

or a monthly average of, roughly, £395,000 for 1917, £263,000 in 1918, and £550,000 in 1919.

The returns show an increase in electrical exports for the eight months of 1919, of £1,247,109, as compared with 1917; and an increase of £2,303,032, as compared with 1918. Increases in values are shown in all the items with the exception of carbons and batteries, the principal improvements occurring in insulated wire, an increase of £570,000; machinery, £275,000; telegraph material, £200,000; and electrical goods, £110,000.

The electrical imports for the past four months totalled £629,866, a reduction of about £6,000 over the previous first four months of the year (January to April, £635,579).

The import figures for the first eight months of 1917, 1918, and 1919, are as follows:—

	1917.	1918.	1919.
January	£309,381	£212,434	£97,292
February	183,192	163,788	178,384
March	286,921	200,966	163,269
April	235,985	87,164	196,634
May	236,799	102,316	190,520
June	186,888	156,311	128,117
July	218,741	152,091	191,002
August	179,901	116,656	120,237
	£1,837,091	£1,191,726	£1,265,445

showing a monthly average in electrical imports of £230,000 in 1917, £149,000 in 1918, and £158,000 in 1919.

The re-exports of foreign and Colonial electrical material fluctuate considerably in value, and attained fairly high levels in May and July, the figures for the past eight months, up to and including August, are:—January, £5,115; February, £11,255; March, £8,108; April, £6,095; May, £24,968; June, £6,316; July, £17,083; August, £9,871; a total of £88,811, or a monthly average of approximately £11,000.

	May.			June.			July.			August.		
	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exp'ts.
Electrical goods ...	101,252	35,178	16,249	107,452	8,916	3,330	92,935	39,065	1,284	130,963	43,892	4,343
Insulated wire ...	174,021	1,117	816	200,058	—	99	194,865	1,982	—	241,125	1,316	42
Glow lamps ...	15,472	54,940	5,019	17,111	15,798	395	17,992	6,596	379	13,114	1,618	17
Arc do. & parts ...	249	7,726	122	513	3,197	—	432	8,095	58	437	8,329	—
Batteries	40,845	4,092	79	33,675	7,049	—	25,002	2,270	2	42,203	2,636	80
Meters	23,914	4,311	59	11,553	2,035	14	19,307	3,279	80	33,524	3,365	118
Machinery ...	123,958	66,670	633	131,579	57,755	1,547	206,432	90,771	743	223,476	47,955	2,407
Carbons	692	4,639	65	285	1,171	21	1,597	3,113	81	1,092	1,967	680
Teleg. &telep. mat'l	91,421	11,847	1,926	115,889	38,186	910	168,479	35,831	14,456	186,715	9,159	2,184
Totals ...	£571,824	£190,520	£24,968	£618,115	£128,107	£6,316	£727,041	£191,002	£17,083	£872,649	£120,237	£9,871

THE BRITISH ASSOCIATION.—III.

Fuel Economy.

Second Report of the Committee.—Prof. W. A. Bone (Chairman), Mr. H. James Yates (Vice-Chairman), Mr. Robert Mond (Secretary); appointed for the Investigation of Fuel Economy, the Utilisation of Coal, and Smoke Prevention.

(*Abstract.*)

Soon after the Committee had drawn up its first report in 1916, the Government, having at length realised the importance of the problem of fuel economy, appointed what afterwards became the Coal Conservation Committee of the Ministry of Reconstruction, under the chairmanship of Lord Haldane. Seven of the then members of this Committee were invited to serve on the Government Committee, which ultimately issued its report and concluded its labours in 1918. One of the first acts of the Coal Conservation Committee was to memorialise the Advisory Council (afterwards the Department) of Scientific and Industrial Research as to the need of a Chemical Survey of British Coalfields, a proposal which originated with this Committee, and had already been strongly urged in its first report.

On November 2nd, 1916, an informal conference was held at the Board of Education between representatives of this Committee and of the Advisory Council, with a view to arriving at some mutually satisfactory arrangement whereby the work of the Committee would be taken over and continued under the ægis of the new Department of Scientific and Industrial Research. It was then represented, on behalf of the Advisory Council, that it was its intention to set up, in the near future, a new Standing Committee on Fuel to organise and carry out, with adequate financial provision, the various lines of research already recommended by this and Lord Haldane's Committee, and that it desired to take over and incorporate in some way with the proposed new organisation the more active members of this Committee. Unfortunately, however, the plan then proposed for so doing (which would have been entirely acceptable to this Committee) was eventually set aside by the Department, which, in February, 1917, established its own Fuel Research Board on a different basis. As it soon became clear that the new Board did not desire any assistance from an outside Committee, no basis of co-operation could be arranged, although the Committee had intimated to the Director of Fuel Research its willingness to collaborate.

For a period of a year afterwards the Committee did not meet, and its work was suspended. In October, 1918, however, in response to a widespread and growing feeling that there was need of an organised body of independent scientific opinion that could be brought to bear, in the public interest, upon any proposals for research of public policy with regard to fuel, the Committee resumed its labours. The reconstituted Committee comprised thirty instead of (as formerly) forty-five members, and the number of the Sub-Committees was reduced from five to three, each with its own chairman and vice-chairman. Finally, an Executive Committee of twelve members was appointed. In view of the vastness and complexity of the manifold issues involved in the present coal situation, the Committee decided to postpone presenting any final report until some future year. The present report is, therefore, of an interim nature.

Coal Outputs and Prices since 1913.

In its first report the Committee drew attention to the vital importance of relatively cheap coal to the nation's industrial prosperity, and stated that, for some years before the war, the average price of coal at the pithead had been decidedly on the up-grade, a tendency which might be expected to continue at an accelerated rate. As the result of circumstances created by, or arising out of, the war, the average pithead price of coal has already almost trebled since the year 1913, and is likely to rise still higher, a matter of most serious concern to the whole nation. Relatively cheap coal is a fundamental necessity to the maintenance, not only of our great iron, steel, engineering, shipbuilding, and textile industries, but of our shipping trade and sea power.

The great need of the moment is that the true facts of the situation shall be brought home to all sections of the community. The committee, therefore, draws attention to the following comparative data concerning the movement of coal prices in Great Britain and the United States during the war period. The figures are all derived from official, or other equally reliable sources.

Outputs of Coal and Average Pithead Prices in Great Britain.

Year.	Total Output. Million Tons.	Annual Output per person employed.	Average pithead price per ton. s. d.
1913	287.4	260	10 1
1914	265.6	238	10 0
1915	253.2	270	12 6
1916	256.3	260	15 7
1917	248.0	247	16 9
1918	227.7	232	(24 0)*

* Estimated.

The upward tendency of prices has continued since the close of 1918, and consumers will have to face an all-round increase of 6s. per ton during the coming winter.

The committee views with concern the recent rapid decline of the annual outputs per worker employed in British mines. This downward tendency was peculiar to British mines.

During the war the British outputs continued to fall at an alarming rate, until in 1918 they reached the low level of 232 tons per worker employed. In marked contrast to this, the American figures continued to rise at an accelerated rate until in 1917 they reached the phenomenal record of 768 tons per worker employed.

American fuel prices have fallen to a level considerably below those ruling in this country, a circumstance which gives American manufacturers a great initial advantage over our own.

Research on the Chemistry of Coal.

Since the previous report, Prof. Bone has continued to direct the research work upon the chemistry of coal at the Imperial College of Science and Technology, London, which he originally undertook in 1916 at the instance of the committee.

In connection with the question of the organisation of systematic investigations upon the chemical characters of the principal British coal seams, the committee reiterates the opinion expressed in its first report, namely, "that the resources, both of existing laboratories which have been established in this country for the special investigation of fuel problems, and of other laboratories where the technique of the subject has been developed, might be utilised more than they are in this connection, and that the time is ripe for the organisation of a scheme of systematic co-operative research aided by national funds in which all such laboratories may participate."

The committee regrets to say, however, that, notwithstanding the establishment of the Fuel Research Board, with large funds at its disposal, no attempt has apparently yet been made to organise any such comprehensive scheme as was recommended in 1916; and it wishes again to impress upon both the public and the Department of Scientific and Industrial Research the danger of sterilising fuel research by a policy of over-centralisation. On the contrary, it is of the opinion that what is most needed is a broadly-planned policy which will aim at stimulating and assisting experimental work on the chemistry of coal, fuel economy, and cognate subjects everywhere throughout the whole kingdom.

Fuel Consumptions in the Iron and Steel and other Industries.

The committee is actively co-operating with the Iron and Steel Institute in promoting fuel economy in iron and steel works. The committee has also been in touch with the Federation of British Industries with regard to the setting-up of an organisation for promoting fuel economy in industrial establishments generally, and for helping manufacturers by expert guidance on matters connected with the use of coal. The question was referred to a special Committee of the Federation, which reported to its executive that it was in the province of the Federation to initiate a scheme, which it hopes shortly to do.

Electric Power Supply.

The Committee has had under consideration the recent reports of various Government Committees upon the question of the reorganisation of public electric power supplies in Great Britain, which is now engaging the attention of Parliament. Whilst recognising the need of such reorganisation, and generally approving (*a*) of the proposed division of the country into areas in which the authorities dealing with the generation and main distribution of electricity shall be co-ordinated, and (*b*) of standardising in each of such areas the frequency and voltage of the main transmission and distribution system, the committee desires to reserve any expression of opinion as to the best means of carrying out the needed reform until the Electricity Commissioners have been appointed and their specific recommendations for the various areas have been published.

Future Standards of Public Gas Supplies.

The committee has had under consideration the report issued on January 29th, 1919 (Parliamentary Paper, Cmd. 108), by the Fuel Research Board in reply to the inquiry of the Board of Trade as to "What is the most suitable composition and quality of gas and the minimum pressure at which it should be generally supplied, having regard to the desirability of economy in the use of coal, the adequate recovery of by-products, and the purposes for which gas is now used."

Recognising that the said report opened up important and far-reaching questions of public policy with regard to the manufacture and distribution of town's gas, the executive referred the whole matter for detailed consideration to a sub-committee. The conclusions of this sub-committee were formally adopted by the committee as a whole, and incorporated in the report as the findings of the committee on the subject.

The committee generally agrees that, provided (*a*) that simple and effective means or apparatus could be devised, and put in general operation, for determining the heat units actually received by each individual gas consumer throughout the kingdom, and (*b*) that certain other conditions were assured, it would be more equitable to charge the consumer on a basis of "heat units" than on one of "cubic feet" supplied.

The committee also agrees generally with the Fuel Research Board's recommendations as to (*a*) the maximum limit of 12 per cent. of inert constituents, and (*b*) the minimum pressure of two inches of water in the gas at the exit of the consumer's meter.

From information supplied to the committee it would appear that the average gross calorific values of the gas supplied during the year 1913 in six of the largest cities of Great Britain ranged from 620 to 540 B.TH.U. The proposal of the Fuel Research Board that in future gas undertakings may be allowed to supply, at their sole discretion, gas of any calorific value between 400 and 500 B.TH.U., ought to be very carefully scrutinised in all its bearings, especially as it involves a considerable dilution of the old "coal gas" by "water gas," with consequent much higher carbonic oxide and lower methane contents.

Its high carbonic oxide content makes water gas a poisonous gas, and, owing to its high hydrogen and low methane contents, its mixtures with air are very liable to back-fire. For these reasons it is not a desirable gas for domestic uses unless largely diluted; and any large admixture of it with coal gas in public supplies would undoubtedly add materially to the dangers of carbonic oxide poisoning and of gas explosions in houses.

The 1899 committee, having in mind the nature of carbonic oxide poisoning and the faulty character of gas pipes and fittings in the poorer class of houses, considered that the carbonic oxide content of a public gas supply should in no circumstances be allowed to exceed 20 per cent., and only exceptionally 16 per cent. The Fuel Research Board's recommendations would allow of a gas company distributing a 40 per cent. coal gas *plus* 60 per cent. water gas mixture, containing between 27.5 and 30.0 per cent. of carbonic oxide.

The committee is unable to agree with the Fuel Research Board's apparent endorsement of the proposition that the relative values of different grades of gases are strictly proportional to their calorific values. The chemical composition of the gas is not a matter of indifference to the consumer, and the cumulative results of 40 years of scientific research on the subject prove that the fundamental properties of the explosive mixtures formed by different combustible gases with air, arising from their own peculiar chemical characters and modes of combustion, do affect profoundly their uses for power and heating purposes.

Hitherto the public has been accustomed to using a gas containing 30 per cent. or more of methane, and it is important that such proportions shall not be unduly diminished. Accordingly the committee would urge the adoption of 20 per cent. as a minimum methane content in a public gas supply intended for domestic consumption.

The gas might be sold (as proposed by the Board) on a thermal basis, subject to the following provisos:—

(*a*) That its methane content shall not be less than 20 per cent., its carbonic oxide content not more than 20 per cent., and its content of "inerts" not more than 12 per cent.

(*b*) That its gross calorific value per cubic foot at 60 deg. F. and 30 in. barometer shall not fall below 450 B.TH.U.

The committee hopes that scientific men generally will strongly support the important recommendation made in the Board's report in regard to sulphur purification. The time has surely come for legislative action in the direction of making such sulphur removal generally compulsory for all large gas undertakings.

Discussion.

In the absence of the chairman of the committee, the report was presented by Mr. R. Mond, who said that the committee was of opinion that all the coals in Great Britain should be carefully examined and classified, so that they would know exactly the best uses to be made of them. Being anxious that there should be a survey of the coalfields of the country, the British Association Fuel Economy Committee had approached the Fuel Research Board with a view to a certain sum being set aside for the purpose, as it was beyond the means of the committee to do that work. That work was more important to-day than it was a few years ago, and the committee was anxious, in spite of the recalcitrant attitude taken up by the Fuel Research Board, that it should be driven home that a real survey of the collieries of the country could easily be made by the nation, or it might be done by the coal industry; it certainly was not a thing which should be done by a committee of chemists.

Sir Robert Hadfield, F.R.S., said that in his own company's works they had thought that they knew a good deal about fuel combustion, and that they were using coal economically, but when they called in a real scientific man on the subject the result was that in a couple of years they were able to save ten times the amount. He did not think there could be a more striking example of applied science to industry than that. He had brought this question of fuel economy to the notice of the Iron and Steel Institute, which intended to devote a whole day to the discussion of it at its autumn meeting. He had also brought it before the Federation of British Industries, which represented some 2,000 firms, and a committee had been formed by the Federation with a view to going into the matter. This committee had already met on a number of occasions, and a valuable report would shortly be presented which he believed would result in further economies. It was of the highest importance to study the question of fuel efficiency, because there were hard times ahead. There was no doubt that the country had been very

wasteful in the past, and in America the waste was prodigious. A walk round the works would often expose little points, and suggestions might come from those handling furances which could be applied to produce further economy. He had found by walking round among the men and stimulating their interest, that they were only too willing to help in matters of economy. His experience had been that given proper interest, the workman was always ready to help his employers. The Research Board was spending a good deal of money, and it was time it gave a little light upon what it was doing.

Mr. C. E. Stromeyer said some very wild statements had been made. For instance, a Cabinet Minister had stated that the average consumption per H.P. was 7 lb. of coal; careful inquiry, however, had shown that the figure was from 2½ to 3 lb. In some cases it was more like 2 lb., and it was by statements of this kind that the nation had been misled into hoping to get greater economies from power schemes than it was likely to get. In many textile factories there were a large number of small steam engines driving their machinery; they were high-pressure-exhaust engines, but the exhaust system was used for heating purposes, and the result was that nominally the consumption of fuel was 7 lb., but for actual power purposes it was about one-third. In shipyards and works of that description where machines had to stand idle for long periods, electricity was much more economical than steam. In those cases power from a large power undertaking was a great advantage, but in the case of factories working continuously at a set speed, there could not be a better arrangement than to produce the power in the works and use it direct.

Mr. Arnold Lupton said he was glad the committee had suggested the limitation of carbonic oxide in gas. The introduction of this poison into our houses was horrible, and if it could possibly be reduced he would support the proposal.

Mr. T. Goulden (Gas Light & Coke Co.) agreed that a survey of the coal fields of the country was most important, because it would assist in getting the coal specially needed for gas manufacture and other special purposes. With regard to gas supply, he, and the gas industry generally, were entirely in sympathy with the policy of producing gas at the lowest possible cost consistent with reasonable safety. The interests of the consumer were also the interests of gas suppliers. It would be impossible to supply gas economically if there was any stipulated composition to adhere to. Gas manufacturers were great economisers of fuel. They not only made the best use of it from the thermal point of view, but they produced sulphate of ammonia and a large number of by-products which were absolutely necessary to the industries of the country generally. To restrict inerts would be to restrict economy.

Sir Charles Parsons (President of the Association) said that the view of Sir George Beilby was that the carbonisation of coal had not been successfully attacked on a scientific basis. He thought it was far too soon to judge the Fuel Research Board. It was working hard, and he believed that in about a year's time good results would be achieved.

Prof. W. H. Watkinson said the country should have some further information as to why the output of coal had decreased so much in this country and not so much in America. He felt that greater economies might be effected by super-gas stations than even by super-electrical stations, because he believed that the energy required throughout the country could be distributed as economically by gas as by electricity. In this country there was an objection to central heating, but if it were effectively carried out there was an enormous saving to be effected in coal.

Lieut.-Colonel. Woodall (Bournemouth Gas and Water Co.) criticised the suggested restrictions upon gas manufacture. What this country had suffered from was over-control. All that the gas companies asked for was greater freedom to carry on their industry not only in their own interests, but in the interests of the consumer. At the present time it was obvious from the proposals put forward that even the Fuel Board did not know what were the best conditions.

Prof. H. E. Armstrong, F.R.S., said they all had the greatest respect for Sir George Beilby, the head of the Fuel Research Board, but there was a strong feeling among chemists that Sir George was keeping the research to himself. It must, however, be made an open one. The Fuel Research Board had taken on the research, and had then warned everybody else off; that was absolutely unsound. Ideas were not centred in one individual or one centre. His own opinion was that the gas industry could not exist many years on its present methods; it would be wiped out if it did not reform its methods. If Lord Fisher's programme was to be carried out it would be necessary to obtain oil from coal in this country, but it could not be done with present methods. Until the gas industry was combined with a power-producing industry they could not solve the problem of using gas for heating purposes. Nobody would use gas for lighting purposes in the future if they could help it. The gas industry must be combined with an industry that was producing gas and a by-product. Within the past few months he had seen an experiment carried out with a ton of a particular coal which gave a most magnificent heating fuel, and in addition, 18 gallons of tar, 15 lb. of sulphate of ammonia, and 8,000 or 9,000 cubic feet of gas. The smokeless fuel amounted to 72 per cent. of the original fuel. Sir George Beilby was a very reticent type of man, and they had got to force him to be less shy.

Geological Section.

Presidential Address by J. W. Evans, D.Sc., I.L.B., F.R.S.—(*Abstract.*)

I propose to consider the methods by which the progress of geological research may be most effectively promoted, and to point out some directions in which I think it possible important advances may be made in the early future.

Many examples could be instanced of the services to geological science by those whose principal life-task lay in other directions. Such workers are unfortunately all too few—fewer, I fancy, now than they were before the pursuit of sport had taken such a hold upon the middle classes, and occupied so considerable a portion of their leisure hours and thoughts. It seems strange that there are so few of our fellow-countrymen or country-women who feel a call to scientific research. Even if the appeal to the imagination were not a sufficient incentive to the cultivation of geology, one would have thought its economic importance would have been effective. Its intimate bearing on the problems of agriculture, engineering, water supply, and hygiene is too obvious to need emphasis, and it is scarcely more necessary to point out that all our fundamental manufacturing activities, without exception, are dependent on adequate supplies of materials of mineral origin.

It is now recognised that no education in science can be considered to be up to university standard if it is limited to a passive reception of facts and theories without any attempt to extend, in however humble a way, the boundaries of knowledge. It is only by the consciousness that he is accomplishing something which has not been done before that the student can experience the keen pleasure of the conquest of the unknown and acquire the love of research for its own sake. At present it is disheartening to realise how few of those who have received scientific instruction understand the obligations under which they lie of themselves contributing to the growth of knowledge. If they have once had the privilege of achieving individual creative work they will henceforward desire to take advantage of every opportunity of continuing it.

At present the analytical work of the Geological Survey is organised on a very modest scale in comparison with the *personnel* and equipment of the laboratory of the United States Geological Survey, though the quality of the work has been as a rule in recent years quite as high.

In the absence of facilities for obtaining rock analysis, petrological work in this country is at present seriously handicapped. This is all the more remarkable in view of the fact that these rocks are closely connected with the pneumatolytic action that has given us almost all the economic minerals of the south-west of England, comprising ores of tin, tungsten, copper, lead, and uranium, as well as kaolin. Another direction in which the work of the Survey could with advantage be extended is in the execution of deep borings on carefully-thought-out schemes. It seems extraordinary that no co-ordinated effort should have been made to ascertain the character and potentiality of this almost unknown land that lies close beneath our feet, and is the continuation of the older rocks of the west and north to which we owe so much of our mineral wealth. It is true that borings have been put down by private enterprise, but, being directed only by the hope of private gain and by rival interests, they have been carried out on no settled plan, and the results and sometimes the very existence of the borings have been kept secret.

If research is to be carried out economically and effectively, it must be organised systematically and directed primarily with the aim of advancing knowledge. If this aim be well and faithfully kept in view, material benefits will accrue which would never have been thought to be sufficiently probable to warrant the expenditure of money on prospecting. It is obviously only right that any commercial advantages resulting from investigations carried out at the public cost should accrue to the State, and, if this principle were adopted, expenditure by the Government on geological research on the lines I have suggested would be sooner or later recouped by the mineral wealth rendered available to the community.

There seems every reason to believe that advances in submarine geology will not only be of scientific interest, but will bring material benefits with them. The working of coal seams and metalliferous veins has been extended outwards beyond low-water mark, and, if evidence should be forthcoming that valuable deposits underlie the shallower waters of the North Sea at any point, there is no reason to doubt that mining engineers would find means of exploiting them. It seems quite possible that off the shores of Northumberland and Durham there are not only extensions of the neighbouring coalfield, but Permian rocks containing deposits of common salt, sulphate of calcium (gypsum and anhydrite), and, above all, potash salts comparable to those at Stassfurt, which have proved such a source of wealth to Germany.

The problem of the structure and nature of the earth's interior, inaccessible to us even by boring, would seem at first sight to be well nigh insoluble. We can, however, gain important information about the physical conditions of the deeper portions from the reaction of the earth to the external forces to which it is subjected, and still more from a study of the "preliminary" earthquake tremours that traverse it. These methods are, however, not applicable to the earth's crust. Its physical characters appear to be distinct from those of the interior, but very little is as yet definitely known

about them. It seems to be separated from the deeper portions of the earth by a surface of discontinuity at which earthquake vibrations travelling upwards towards the surface may be reflected. The main earthquake vibrations appear to follow the curvature of the earth, and to be confined to its crust, instead of traversing the interior, as is the case with the preliminary tremours. In these vibrations a period of about seventeen or eighteen seconds is usually predominant, and is believed to be due to the natural period of vibration of the earth's crust. There seems, however, to be no warrant for supposing that the lower surface of the crust is capable of free vibration. The velocity of the propagation of waves round the earth's crust, in all probability a complex process, is not the same as the true velocity of vibrations passing upwards and downward through the earth's crust. Those with a period of about 18 seconds appear to consist partly of horizontal vibrations and partly of vertical; the former would seem to correspond to waves of distortion, and the latter to waves of compression. However, in the present state of our knowledge of these vibrations such calculations are only of speculative interest.

It deserves consideration, however, as to how far it may be possible to add to our knowledge of the earth's crust by experimental work with a view to the determination of surfaces of discontinuity by their action in reflecting vibrations from artificial explosions, a procedure similar to that by means of which the presence of vessels at a distance can be detected by the reflection of submarine sound waves. The ordinary seismographs are not suited for this purpose; the scale of their record, both of amplitude and of time, is too small for the minute and rapid vibrations which would be expected to reach an instrument situated several miles from an explosion, or to distinguish between direct vibrations and those that may arrive a second or two later after reflection at a surface of discontinuity. As the cylinder on which the record is made would be only in motion while the experiment was in progress, there would be no difficulty in arranging for a much more rapid movement. At the same time it would be desirable to dispense with any arrangement for damping the swing of the pendulum, which would be unnecessary with small and rapid vibrations, and would tend to suppress them. It is possible that it might be better to employ a seismograph which records, like that devised by Galitzin shortly before his death, variations of pressure expressing terrestrial acceleration, instead of one which records directly the movements of the ground. It would, however, probably be found desirable to substitute for the piezo-electric record of pressure employed by Galitzin a record founded on the effect of pressure in varying the resistance in an electric circuit. This is, in fact, the principle of the microphone and most modern telephone receivers, but quantitatively they are very unreliable. This would not matter so much for the present purpose, where the time of transmission is the most important feature in the evidence, but satisfactory results even in this respect appear to be given by Brown's liquid microphone, from which the record could be taken, if desired, by means of the reflection of a mirror, attached to the needle of the galvanometer. Evidence of the structure of the earth's crust is also afforded by observations on the direction and magnitude of gravitation which have been carried out in considerable detail in India and the United States. At the present time the problem of correlating the variations observed with the underground structure is only in an embryonic stage.

The same remarks apply to the results obtained by magnetic surveys. Apart from the marked effect of masses of magnetite in the immediate neighbourhood of the surface, local magnetic irregularities appear to be mainly determined by the presence of basic igneous rocks, but there seems to be considerable room for research as to the relation between these phenomena and the form and composition of an igneous intrusion.

In this review of some of the possibilities of geological research I cannot claim to have done more than touch the fringe of the subject. In every direction there is room for the development of fresh lines of investigation, as well as for renewed activity along paths already trodden.

How the Sun might have become a Magnet.

By Sir Joseph Larmor.

Section A.—Mathematical and Physical Science.—Abstract.

The obvious solution by convection of an electric charge, or of electric polarisation is excluded; because electric fields in and near the body would be involved, which would be too enormous. Direct magnetisation is also ruled out by the high temperature, notwithstanding the high density. But several feasible possibilities seem to be open.

1. In the case of the sun, surface phenomena point to the existence of a residual internal circulation mainly in meridian planes. Such internal motion path around the solar axis planes. Such internal motion induces an electric field acting on the moving matter; and if any conducting path around the solar axis happens to be open, an electric current will flow round it, which may in turn increase the inducing magnetic field. In this way it is possible for the internal cyclic motion to act after the manner of the cycle of a self-exciting dynamo, and maintain a permanent magnetic field from insignificant beginnings, at the expense of some of the energy of the internal circulation. Again, if a sunspot is regarded as a superficial source or sink of radial flow of strongly ionised material, with the familiar vortical features, its strong magnetic field would, on these lines, be a natural accompaniment; and if it were an inflow at one level compensated by outflow at another level, the flatness and vertical restriction of its magnetic field would be intelligible.

2. Theories have been advanced which depend on a hypothesis that the force of gravitation or centrifugal force can excite electric polarisation, which, by its rotation, produces a magnetic field. But, in order to obtain sensible magnetic effect, there would be a very intense internal electric field such as no kind of matter could sustain. That, however, is actually got rid of by a masking distribution of electric charge, which would accumulate on the surface, and in part in the interior where the polarisation is not uniform. The circumstance that the two compensating fields are each enormous is not an objection; for it is recognised, and is illustrated by radioactive phenomena, that molecular electric fields are, in fact, enormous. But though the electric masking would be complete, the two distributions would not compensate each other as regards the magnetic effects of rotational convection; and there would be an outstanding magnetic field comparable with that of either distribution taken separately. Only rotation would count in this way; as the effect of the actual translation, along with the solar system, is masked by relativity.

3. A crystal possesses permanent intrinsic electric polarisation, because its polar molecules are orientated; and if this natural orientation is pronounced, the polarisation must be nearly complete, so that if the crystal were of the size of the earth it would produce an enormous electric field. But, great or small, this field will become annulled by masking electric charge as above. The explanation of pyro-electric phenomena by Lord Kelvin, was that change of temperature alters the polarisation, while the masking charge has not had opportunity to adapt itself, and piezo-electric phenomena might have been anticipated on the same lines. Thus, as there is not complete compensation magnetically, an electrically neutralised crystalline body moving with high speed of rotation through the æther would be expected to produce a magnetic field; and a planet whose materials have crystallised out in some rough relation to the direction of gravity, or of its rotation, would possess a magnetic field. But relativity forbids that a crystalline body translated without rotation at astronomical speeds should exhibit any magnetic field relative to the moving system.

The very extraordinary feature of the earth's magnetic field is its great and rapid changes, comparable with its whole amount. Yet the almost absolute fixity of length of the astronomical day shows extreme stability of the earth as regards its material structure. This consideration would seem to exclude entirely theories of terrestrial magnetism of the type of (2) and (3). But the type (1), which appears to be reasonable in the case of the sun, would account for magnetic change, sudden or gradual, on the earth merely by change of internal conducting channels; though, on the other hand, it would require fluidity and residual circulation in deep-seated regions. In any case, in a celestial body residual circulation would be extremely permanent, as the large size would make effects of ordinary viscosity nearly negligible.

The Simplex X-ray Apparatus.

In Section A, mathematical and physical science, was exhibited an X-ray apparatus manufactured by Messrs. Newton and Wright, of London, a feature which primarily distinguished the apparatus being the fact that all mechanical mechanism can be eliminated when the supply current available is alternating. For this reason it has been given the title of "Simplex." The first outfits made on this principle were the field service sets used by the American Army in France, but the apparatus which is now being placed on the market is the first to be manufactured entirely in this country. The apparatus can only be used with the radiator type of Coolidge tube, and the firm now has in course of construction a tube holder and protective shield specially suitable for attachment to this apparatus.

The elimination of all moving parts from the apparatus is made possible by the radiator type of Coolidge tube, which has the property (between limits) of completely rectifying an alternating current, it can therefore be energised by a high-tension transformer without the aid of any mechanical or other form of rectifier. The advantages of this will be apparent to all X-ray workers, as it means simplicity and compactness of the apparatus coupled with the entire absence of noise. When a direct-current supply only is available a rotary converter can be included to produce the necessary alternating current; this machine need not necessarily be contained in the apparatus itself, but can be fitted in another room.

In the Simplex No. 1 apparatus, the output obtainable has been limited and fixed in quantity, as by doing so it is possible to make the efficiency of the transformer so high that, while keeping the power employed within the limitations of ordinary electric light wiring, X-rays of very reasonable volume can be produced. The apparatus can, therefore, be worked from an ordinary lighting socket without any special wiring being required, and under these conditions an output up to 5 milliamperes at a 5-in. equivalent spark gap can be obtained according to the voltage of the supply mains available. Owing to the output being a fixed factor it is only necessary to vary the time of exposure according to the part

of the body which it is required to radiograph, and a simple chart is being prepared indicating at a glance the exposure required. A copy of this will be supplied with each outfit.

The apparatus which is at present being made is designed in the form of a trolley suitable for hospital ward work, but its use is by no means limited to this purpose; it is mounted on large caster wheels, and is provided with a pair of handles for carrying. The outfit includes a pair of helix reel cables, the reel on the cathode side being specially constructed to take the twin flexible cable necessary to carry the filament current. A milliamperemeter is also provided which is connected in the transformer circuit at the point of zero potential —although reading the current passing through the tube this instrument is itself practically earthed, and consequently it can be mounted on the cabinet near the control switch instead of having to be placed near the tube on the highly insulated support hitherto required.

Radio-Telegraphic Investigations Committee.

Sir Oliver Lodge, Chairman; Dr. W. H. Eccles, Secretary.

Section A.—Mathematical and Physical Science.—(Abstract).

During the past twelve months the war-time restrictions on wireless telegraphy have continued in operation. A few statistical records from British Colonial wireless stations have been sent regularly to the committee, and occasional information from other parts of the world has been received. In connection with the solar eclipse of May 29th, 1919, the committee arranged for the carrying out of experiments on the effect of the eclipse on signals transmitted across the central line. The British Admiralty stations at Ascension and the Azores transmitted continuously during the transit of the umbra across the Atlantic Ocean. Observing stations north of the equator were for the most part asked to listen to Ascension for at least an hour about the time when the umbra passed between themselves and Ascension; observers south of the equator were asked for the most part to listen to the Azores. Certain selected stations north of the equator were asked to listen to the Azores, so as to afford check observations upon the variations which might be observed in signals passing across the central line of the eclipse, and, similarly, selected stations south of the central line were asked to listen to Ascension. The American station at Sayville also transmitted a programme during a portion of the period of the eclipse, and arrangements were made for special experiments between Darien and the Falkland Islands, and between an Egyptian station and a South African station. The main portion of the experiment hinged upon Ascension. The umbral cone passed from west to east, and was expected to effect in succession the strength in which signals were received at such stations as Demerara, Jamaica, the stations on the coast of the United States and Canada, stations in Ireland, England, France, Italy, in the Mediterranean and Egypt.

The Limitations of Relativity.

By W. J. Johnston and Sir Joseph Larmor.

Section A.—Mathematical and Physical Science.—(Abstract.)

The following propositions are believed to be valid, on the basis of a concise symbolic calculus, subject, of course, to critical verification.

(1) If a field of physical activity possesses the two characteristic properties (i) that the quantities which define it are propagated through the æther with a single constant velocity, and (ii) that translatory uniform convection as a whole through the æther produces no modification in the field, then it is necessarily restricted to the special type of the electrodynamic field as formulated by Maxwell.

(2) A field of gravitation is included as the limiting form of such a type when the velocity of propagation becomes very great. As like source is now to attract like, the energy of the field must be kinetic and not elastic. The question of interaction between a field of gravitation and electric fields or rays of light is, of course, a separate and fundamental one, independent of theories of relativity, and is now being put to refined test by astronomical observation.

(3) If time were linked with space after the manner of a fourth dimension, relativity in electrodynamic fields would be secured as above, but the sources of the field could not be permanent particles or electrons. If physical science is to evolve on the basis of relations of permanent matter and its motions, time must be maintained distinct from space, and the effect of convection must continue to be thrown on to the material observing system in the form of slight modification of its structure.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Seewer" Pelton Wheel Regulator.

A new type of spear regulator for Pelton wheels has recently been introduced by M. Seewer, a Swiss engineer, and has been successfully tested at the Zurich Polytechnic.

As will be seen from fig. 1, which gives a longitudinal section of the regulator attached to a Pelton wheel, the distinctive feature of the design consists in the use of a series of pivoted vanes P inside the nozzle, arranged round the

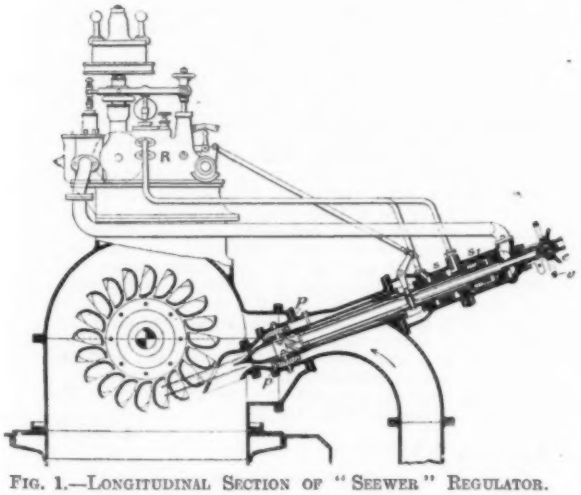


Fig. 1.—Longitudinal Section of "Seewer" Regulator.

central spear in the shape of a symmetrical star. By means of a simple mechanism the vanes are all equally inclined or kept parallel to the axis of the nozzle. In the latter position they produce no effect upon the issuing cylindrical water jet (fig. 2), which then exerts its maximum force upon the runner buckets. The smallest inclination, however, acts upon the jet in a remarkable manner, changing it, as shown in fig. 3, into a cone, this effect being more and more accentuated as the inclination of the vanes is increased. The deflector used is pierced to pass the cylindrical jet, but on the operation of the vanes it intercepts the coned jet, and in this way suppresses its action upon the wheel buckets.

As the vanes only effect the dispersal of the jet without reducing the rate of flow, their action does not give rise to any excess pressures or water hammer in the pipe line. Moreover, the reactions of the water on the front and back faces of the vanes being balanced, they can turn on their axes, and respond almost instantly to load fluctuations, whilst the power required to actuate them is reduced to a minimum. The maximum inclination of the vanes is 20 degrees. They are actuated by means of the servo-motor s, through the

Fig. 2.—Normal Form of Jet.

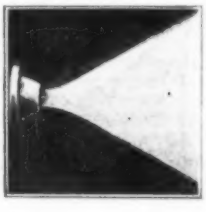


Fig. 3.—Jet Formed when the Vanes are Inclined.

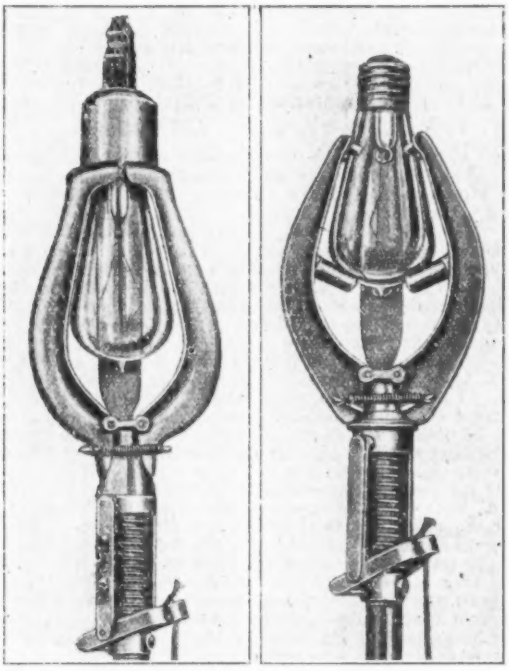
governor R, which also controls the movement of the spear through the second servo-motor s_1. Hand regulation can also be made, if desired, by engaging the hand-wheel v with the control spindle through the clutch c.

When sudden changes in the load occur the two servo-motors act together; the one controlling the vanes acts instantly, that of the spear completing its effect. With only small fluctuations in the load the spear servo-motor alone comes into play, and the vanes remain inoperative.

In the *Schweizer Bauzeitung* of May 31st and June 7th, Prof. Prasil, of the Zurich Polytechnic, who supervised the tests gives the results with a number of tables and diagrams, and reports in favour of this system as constituting a notable advance in the regulation of Pelton wheels.—*Génie Civil.*

G.C.A. Lamp Renewers.

These practical tools, illustrated in figs. 4 and 5, and manufactured by the G.C.A. Manufacturing Co., Pittsfield, Mass., U.S.A., enable lamp renewals to be made easily from the ground without the necessity of pole climbing or the use of



Figs. 4 and 5.—Lamp Renewers.

ladders. It is claimed that they save expense, time, labour, lamps, and delay in renewals, as well as the hazard of injury to employés. They are made in two types and four models. The series type pulls the socket and lamp together, and replaces the refused socket with the lamp, as shown in fig. 4. The multiple type unscrews and replaces bulbs having fixed sockets, and an attachment will remove broken bulbs.—*Elec. News.*

A Tramway Seat Indicator.

A tramway and omnibus seat indicator, which we understand has been perfected by Mr. G. F. Ball, 4, Featherstone Buildings, High Holborn, London, and 88, Pitt Street, Sydney, has been designed to eliminate delay and confusion which often occur as the result of the public being unable to see the number of vacant seats at the top or outside of these vehicles, particularly after dark. By the use of this indicator the number of seats vacant is shown clearly in bold figures. If no seats are vacant, the figure 0 appears on the dial; if figure 7 is shown and two persons ascend the stairs, the figure 5 at once appears, or, conversely, if two persons descend, then the figure 9 is indicated. The mechanism within the indicator is very simple, strongly constructed, and cannot get out of order; it is operated by a slight movement of an iron tread on two of the steps. The indicator may be fixed at any convenient position or placed flush in the rise of one of the steps. The device should materially assist in the efficient working of cars; besides the convenience afforded to the public it gives the conductor a check on the number of passengers outside.

Roads and Transport Congress and Exhibition.—This event has been arranged for November 20th to 27th, at the Royal Agricultural Hall, London. The papers to be read include the following:—"The Consolidation and Amendment of the Highways Law," by H. Hampton Connall; "The Conditions Under which the Heavier Types of Vehicles may Use the Roads, with Special Reference to their Liability for Extraordinary Traffic Damages," by Sydney G. Turner; two papers on "The Weight, Construction and Speed of Mechanically-Propelled Vehicles in Relation to the Construction and Maintenance of Roads"—one paper to be read by a manufacturer of such vehicles, and the other by a road engineer (Albert E. Brookes, County Surveyor, Durham); "Provisions for, and Development of, Traffic in the Future, with Special Reference to (*a*) the Provision of New Roads, (*b*) Road Finance, and (*c*) Provision of New Transport Services," by W. Rees Jeffreys. Among the firms announced in the preliminary list of exhibitors are:—W. & T. Avery, Ltd.; Edison Accumulators, Ltd.; General Vehicle Co., Ltd.; J. & E. Hall, Ltd.; Hadfields, Ltd; Ransomes, Sims & Jefferies, Ltd.; Tilling-Stevens, Ltd.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Noiseless Tramcars.

Among the non-technical portion of the community there is a growing antagonism to tramways and tramway systems. The rails tend to make the roads unsafe for vehicular traffic, the overhead equipment is anything but beautiful, and, in addition, the noise usually associated with modern tramcars is best described by the word "nerve-racking."

This seems to me to be a direct challenge to British tramway engineering. Surely the engineers responsible for the design of our tramways can devise some means of absorbing the shocks and incidentally the noises which are at present part and parcel of street cars.

It is evident that unless some improvement is made in this direction in the very near future, public opinion throughout the country will begin to substitute rival methods of transport, such as motor omnibuses.

I am persuaded that if a little serious attention be devoted to this feature it is possible for a "noiseless" tramcar to be evolved, which would make this form of city travelling a pleasure instead of a painful necessity as at present.

If tramway engineers reply that it is impossible to reduce the noise, then the conclusion to be drawn is that electric tramways are played out.

E. E. Walker.

Birmingham, *September 16th*, 1919.

Balancing and Alignment of the Alternator Rotor.

I thank Mr. Kelman for raising the points in regard to my article, and have pleasure in replying to the most important ones as follows:—

1. The details contained in the article are *facts*, and they occurred in a large power house not many miles from the place where I am writing.

2. Referring to the firing of end shields, Mr. Kelman has probably in mind the old type of felt wipe shield with which, of course, firing was impossible. I have known the modern shield, with gun-metal labyrinth sections, to fire although when stationary a clearance of at least .008 in. was ascertained.

3. After running in, any vibration may be said to be due to defective balance. During running in, excessive vibration may be due to anything from defective balance to a defective thrust block or grinding of labyrinth packings.

4. The use of two balancing weights in separate grooves is certainly much better than one weight, since a finer adjustment may be obtained.

C. Sylvester, A.M.I.E.E., &c.

Coventry, *September 20th*, 1919.

Free Advice.

Why are engineers expected to give free advice to all and sundry? We are approached by directors of companies, manufacturers, &c., for details of the behaviour of such and such an engine or plant, for the cost of a certain installation, the size of motor required for such a purpose, &c.

Quite a proportion of such inquiries come from directors of electrical concerns who have their own engineer, and are an indirect method of getting a second opinion.

Legal directors are experts at this, they are at home on cross-examination and pump expert opinion without trouble.

Ask one of these gentlemen a legal question and you find an oyster (requires a gold—or post-war—paper knife to open). Why cannot engineers keep their experience for sale, or at least for the benefit of brother engineers? Let these directors pay for a second opinion or risk the opinion of the engineer they pay to manage their property.

Representatives of engine and plant manufacturers—whether trained engineers or not—and municipal and company engineers will get out schemes for prospective customers. The first are out of control, and their schemes confined to the goods they have for sale, but the second class should not interfere with the work of the consulting engineer.

The medical man refers one to the specialist, the solicitor to the barrister, and the architect requires the quantity surveyor; why cannot engineers act likewise?

Why not require payment for our experience? Most of us had to pay pretty stiffly for it.

A.M.I.E.E.

September 19th, 1919.

Appointments in India.

The statement made by some advertisers that a rupee is worth one shilling and tenpence is very misleading to those about to apply for berths in India, as they calculate by that that they will be getting an equivalent to £1 for every Rs. 11. That is only the commercial value of a rupee, as fixed by the international rate of exchange. Before the war, and well into 1916, a rupee was worth one shilling and fourpence, or Rs. 15 to £1. Since the war, the cost of living and common necessities, including servants, has greatly in-

creased, so that a rupee is only worth, in spending value, three-quarters of what it was worth in pre-war days.

In big cities like Bombay and Calcutta a single man will have to pay about Rs. 150 per month for board and lodging if he wishes to live fairly decently. He will find conveyances a fairly large item, as Europeans nearly always travel by gharries (Victoria carriages) or taxis.

Just now there is a great demand for engineers in India, and there will naturally be many leaving England to take up appointments there. I would advise them first, to make full investigations as to how much better off they will be in India, in pocket and health, than in England after a few years.

W. T. I. Turner.

Kentish Town, N.W.
September 22nd, 1919.

Boiler-house Practice.

Mr. F. D. Napier's letter published in the REVIEW of the 12th inst. points to the difficulty of obtaining accurate data by which the engineer may readily know what his boilers are actually generating from a given amount of fuel. Surely the best system is to install reliable steam flow meters. These are, I believe, fairly reliable; they give a record of the total steam passed and also chart readings by which one can see the consumption of engines or other users over a period, and have indicators to show the bow at any moment.

This appears to me to be the best method of arriving at what any boiler is doing, and what any steam unit is consuming. The meters I have in mind are made by George Kent, Ltd.

Wm. Jealous.

London, S.E., *September 17th*, 1919.

Compilation of Trade Publications.

Mr. F. N. Pickett, referring to my letter of August 13th, on the above subject, fully endorses the spirit of my remarks so far as he confines himself to the subject. I make allowance for the light-hearted way in which he irreverently brackets my name with certain public notabilities (although for the life of me I cannot understand how he managed to hit upon such an eminent trio!), but I will leave it at that, as the matter is really too serious to indulge in personalities.

So far as his concluding remarks are concerned, I am able to state that not only has a workable scheme of engineering publicity been formulated, which will give "real practical service," but the scheme has actually been demonstrated in the compilation of the booklet entitled "Les Progrès de l'Electricité Appliquée," copy of which I am enclosing for your perusal.

This booklet is the practical outcome of the effort of certain members of the "Beama" to produce by co-operative means a booklet for distribution at the Athens Exhibition. For some time now, British manufacturers—particularly those interested in overseas trade—have realised the important part which comprehensive literature plays in building up overseas connections. Generally speaking, British enterprise has not been lacking in supporting trade exhibitions, and in going out to meet in fair competition our various rivals for overseas markets. It has often been noticed that German publicity methods before the war, and American publicity methods of to-day, are superior to our own. This has in many cases enabled them to secure business which might well have come to us, even when they have not offered the advantage in design, construction, or even in price.

I agree with Mr. Pickett that the credit for inception and carrying out of this effort for the members of the "Beama" is not attributable to any of the so-called advertising experts; indeed, it is my belief that no advertising service, so-called, exists in this country at any rate, which is capable of giving real service to technical advertisers or in improving generally British engineering publicity.

I repeat the contention in my letter of August 13th that I believe that co-operative effort is the only solution to the present problem, which Mr. Pickett, among others (not politicians), fully agrees exists. I hesitate to trespass further upon the hospitality of your columns to enlarge upon the enormous possibilities of co-operative effort in British engineering publicity methods, but if you wish I should be very glad to draft an article bearing on the many aspects of this matter for publication in an early edition of the ELECTRICAL REVIEW.

P. W. Laverick.

London, *September 23rd*, 1919.

Loose-leaf Pocket Books.

In answer to your query in the current issue, I am unable to say whether the American publisher got the idea from the British source you mention, but it is significant that the so-called "Lefax system" was started seven years ago, or two years after Walker's Engineer's Pocket Book appeared on the market.

I enclose a copy of the Lefax Magazine, which refers to the above remark on page 51. While this magazine is issued monthly, and in conjunction with the data-sheets, it must not be confused with them as they are distinct. The publication of these data sheets is partly governed by requests received from subscribers to the magazine.

My chief objection to the Lefax system is that the American wire gauge, gallon, and ton are not of our dimensions, and consequently a number of the sheets are of little service to a Britisher. Now, why cannot we get out a "system" on similar lines in this country? I would gladly co-operate myself in such a useful enterprise.

C. A. Smith, A.Am.I.E.E.

Birmingham, *September 22nd*, 1919.

[It is clear that the system referred to by our correspondent has been very highly developed, and is a living system—the data sheets are not issued once for all, or even at intervals of years, but are constantly being revised, replaced, or added to. Moreover, they are regularly published in nine classes, mainly concerned with the engineering industries. The scheme is certainly one to be commended.—EDS. ELEC. REV.]

Is there a Portable Sonometer?

In your editorial last Friday, on p. 354, you mentioned that an instrument was required, "so that the investigator could study sounds of all kinds in a quantitative manner." Such measurements as you refer to have, I think, been made by means of (1) Rayleigh disk; (2) telephone and galvanometer; (3) tuning forks associated with mirrors. Noise in rooms has been measured quantitatively by means of a telephone against a standard source of sound produced by a buzzer. A description of measurements of the first three types can be found in the following papers:—

Berger: *Gesundheits Ingr.*, v. 34, p. 925, 1911.
Henchy: *Naturwissenschaften*, v. 5, p. 97, 1917.
Ottenstein: *Gesundheits Ingr.*, v. 36, p. 433, 1913.
Weisbach: *Ann. der Phys.*, v. 33, p. 763, 1910.
Taylor: *Phys. Review*, v. 2, p. 270, 1913.
McGinnis: *Phys. Review*, v. 32, p. 128, 1911.
Watson: *Phys. Review*, v. 7, p. 125, 1916.
Tufts: *Amer. Jour. Science*, v. 11, p. 357, 1901.

It is true enough that none of the instruments mentioned above are portable, but are you quite sure that no such portable instrument exists?

Alec. B. Eason.

London, E.C., *September 22nd*, 1919.

[We cannot be certain that no such instrument is in existence, but we never heard of one.—EDS. ELEC. REV.]

Automatic Heat Control.

Your leading article on "Automatic Heat Control" is of particular interest, as it is a problem which I was called upon to deal with as far back as 1903; the purpose of the apparatus was to provide a chamber suitable for the cultivation of bacteria for research purposes at the University of Edinburgh, in connection with the newly-established chair of Public Health and Sanitary Science.

Much of the apparatus installed was imported from Germany, including temperature controlling apparatus regulated by means of a mercurial thermometer.

It was found in practice, however, that every time the circuit was "made" or "broken" due to a change of temperature in the room, a portion of the mercury was evaporated and recondensed in the thermometer tube above the contact line, with the result that the temperature gradually rose until it was unsuitable for the purpose for which it was intended.

I enclose an abstract of a paper which I read before the Royal Scottish Society of Arts on the apparatus which I made to replace that supplied from Germany, and which is still, I understand, in use.

I have installed similar apparatus for culture purposes since then, but instead of using water circulation have furnished heat by means of modern radiators, and the arrangement is exceedingly accurate.

For industrial purposes where a temperature variation of several degrees might be allowed, a simple device might be used and the magnetically controlled switch could be eliminated, materially reducing the cost of the apparatus.

Basil A. Pilkington.

Edinburgh, *September 17th*, 1919.

[The paper (January 11th, 1904) describes apparatus controlled by a bimetallic thermostat, which closes the circuit of a relay when the temperature rises above the normal and cuts out a heating device.—EDS. ELEC. REV.]

Japanese Hold on Indian Trade.—A correspondent of *The Times* says that during the war Japanese traders obtained a strong hold on the Indian market. In the year 1918-19, imports into India from Japan reached a value practically equivalent to one-fifth of India's total import trade. In 1911 there were only 32 male Japanese in India; there are now large Japanese colonies both in Calcutta and Bombay, which appear to be steadily growing in numbers and importance. Three Japanese exchange banks, moreover, are carrying on business in India, whereas three years ago there was only one.

NEW PATENTS APPLIED FOR, 1919.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

22,022. "Sparking plugs." W. T. Smith. September 8th.

22,036. "Wireless telephony system." W. P. Thompson. (Soc. Francise Radio Electrique.) September 8th.

22,039. "Thermionic devices." J. Scott-Taggart. September 8th.

22,042. "Magneto motor." D. Suchostawer. September 8th.

22,068. "Electrodes for electric furnaces, &c." Norske Aktieselskab for Elektrokemisk Industri Norske Industri-Hypotekbank. September 8th. (Norway, January 17th.)

22,074. "Electrical apparatus." British Thomson-Houston Co. (General Electric Co.) September 8th.

22,090. "Electric tramways." C. H. Watkins. September 8th.

22,091. "Control devices for electrically-driven lifts, cranes, winches, &c." V. Breeze and A. West & Co. September 8th.

22,098. "Commutators for internal-combustion engines." S. S. Chenhall. September 8th.

22,099. "Wireless telegraph and telephonic apparatus." L. G. Redmond-Howard. September 8th.

22,105. "Operating synchronous telegraph systems." A. E. O'Dell. (Western Union Telegraph Co.) September 8th.

22,114. "Pulleys for trolley poles of electric tramcrs, &c." G. A. Bishop and R. A. Chadwick. September 9th.

22,118. "Electric-light fittings, &c., for vehicles." H. Gray. September 9th.

22,126. "Sparking plugs." H. Longton. September 9th.

22,127. "Electromagnetic wave navigational systems." W. P. Thompson. (Bethenod.) September 9th.

22,155. "Sparking plugs." D. McLaughlin. September 9th.

22,162. "Electrically-operated lifting-jack." F. W. Berwick & Co. and M. H. L. Sizaire. September 9th.

22,171. "Telephone receivers." E. Hausdorf. September 9th.

22,172. "Fastening toothed wheels in magneto-electric ignition apparatus." Scintilla. September 9th. (Germany, October 1st, 1918.)

22,173. "Apparatus for diminishing injurious earthing currents in earthed high-pressure nets." Akt.-Ges. Brown Boveri et Cie. September 9th. (Switzerland, December 23rd, 1918.)

22,175. "Electric relays." British Westinghouse Electric and Manufacturing Co., G. A. Cheetham and H. Lister. September 9th.

22,184. "Cooling and ventilation of dynamo-electric machines." K. Baumann and British Westinghouse Electric and Manufacturing Co. September 9th.

22,205. "Means for locking electric switches." G. T. Waite. September 10th.

22,206. "Means for indicating faults in electric ignition circuits of internal-combustion engines." G. T. Waite. September 10th.

22,240. "Means for sound reproduction for gramophones." T. Hudgell. September 10th.

22,247. "Electro-magnetic braking apparatus for electric railway, &c., vehicles." G. L. Meyfarth. September 10th. (Switzerland, September 19th, 1918.)

22,263. "X-ray apparatus." British Thomson-Houston Co. (General Electric Co.) September 10th.

22,287. "Installation for charging a battery of accumulators." F. Maukon. September 10th. (Switzerland, September 10th, 1918.)

22,288. "Current-reversing devices for dynamos turning in both directions." F. Maukon. September 10th. (Switzerland, September 10th, 1918.)

22,289. "Automatic voltage regulation of variable-speed dynamos." F. Maukon. September 10th. (Switzerland, September 10th, 1918.)

22,290. "Automatic regulation of parallel working of variable-speed dynamos and accumulators." F. Mauron. September 10th. (Switzerland, September 10th, 1918.)

22,299. "Dynamo-electric machines." E. J. Harman and E. le Bas. September 10th.

22,302. "Obtaining alternating currents of any frequency from three-phase systems of any other frequency." A. M. Taylor. September 10th.

22,304. "Intercommunication telephone systems." H. Robinson. September 11th.

22,313. "Devices for cutting off current of electric lifts, &c., when gates are open." A. Bennett and English Sewing Cotton Co. September 11th.

22,331. "Series-current relay." T. Coughtrie. September 11th.

22,332. "Telegraph printing-machines." Automatic Telephone Manufacturing Co., H. H. Harrison, F. G. Redford and S. R. Smith. September 11th.

22,358. "Method of control for battery-driven electric motors." R. M. Ellis. September 11th.

22,371. "Electric motor control systems." T. Zweigbergk. September 11th.

22,377. "Process for manufacture of zinc cylinders for primary batteries." S. O. Cowper-Coles. September 11th.

22,378. "Means for punching telegraphic tape." R. N. Vyvyan. September 11th.

22,391. "Generators for high-frequency oscillations for wireless telegraphy." V. J. F. Bouchardon. September 11th. (France, November 21st, 1918.)

22,428. "Electrical wire or cord, &c., adjusters." E. Westrup and O. F. Westrup. September 12th.

22,445. "Trolley guide for electric tramcars with overhead system." E. S. Cattell. September 12th.

22,494. "Thermionic valves, &c." General Electric Co. and C. F. Trippe. September 12th.

22,541. "Electrolytic cells for deposition of metal from solution." W. E. Harris, Metals Extraction Corporation and T. M. Williams. September 13th.

22,545. "Electric lamp fitting." M. J. Railing and T. Taylor. September 13th.

22,554. "Means for locking electric switches of ignition circuits of motor vehicles." S. E. M. Gilbert. September 13th.

22,555. "Electric lamps." T. A. D. Lawton. September 13th.

22,564. "Regulating-switch for electric clocks or time transmitters." H. Driver. September 13th.

22,581. "Electric transformers." S. Z. de Ferranti. September 13th.

22,583. "Portable electric lamps." C. W. Bancroft and A. Ross. September 13th.

22,589. "Electric incandescent lamps." G. Calvert. September 13th.

22,592. "Starting rheostats for electric motors." A. H. Buckley and R. A. Buckley. September 13th. (Australia, September 13th, 1918.)

22,600. "Electric lighting fixtures." H. C. Adam. September 13th. United States, October 8th, 1918.)

22,601. "Electrical joint, junction and disconnecting box." B. Wheeler. September 13th.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.

2,514. Sparking plugs for internal-combustion engines. A. Gaethofs. August 29th, 1918. (131,322.)

7,515. Electrically-heated apparatus for evolving gases from liquids. B. G. Cooper and E. A. Griffiths. May 4th, 1918. (131,344.)

7,610. Sparking plugs for internal-combustion engines. H. V. J. Jouffret. October 24th, 1917. (131,352.)

8,287. Radio-signalling system. L. de Forest. June 16th, 1917. (131,361.)

8,318. Audion or lamp relay or amplifying apparatus. M. Latour. October 23rd, 1916. (Divided application on 15,543/17. Addition to 5,363/17.) (131,362.)

8,524. Battery charge-indicating device. Domestic Engineering Co. July 30th, 1917. (118,595.)

8,623. Apparatus for measuring and indicating an electricity supply. L. R. Lester. May 24th, 1918. (131,405.)

8,761. Electro converter furnaces and process of treatment for the manufacture of steels thereby. P. F. Sarron and J. Simon. May 27th, 1918. (131,372.)

8,881. Ignition devices for projectile fuses. F. W. Vickery. May 29th, 1918. (131,374.)

9,018. Systems for distributing electric energy. C. H. Wordingham. May 31st, 1918. (131,377.)

10,025. Apparatus for the concentration of electric waves in a single direction or upon a fixed point. L. Rota and E. Binetti. June 18th, 1918. (Addition to 11,658/17.) (131,392.)

10,059. Electrodes for electric arc welding. E. Languepin. October 31st, 1917. (Divided application to 15,888/17.) (131,395.)

11,657. Electric circuit controlling devices. E. C. R. Marks. (Splitdorf Electrical Co.) July 16th, 1918. (131,410.)

12,217. Relay for electric circuits. D. A. Christian. July 26th, 1918. (131,413.)

13,321. High-frequency electric signalling. Western Electric Co., (Western Electric Co.) August 16th, 1918. (131,426.)

13,350. Electric motors. M. V. O'Leary. August 16th, 1918. (131,429.)

13,642. Cleaning metals by electrolysis. I. Jascowitz and J. Rosenbaum. August 22nd, 1918. (131,455.)

13,869. Commutators for use on internal-combustion engines. F. G. Hayward. August 26th, 1918. (131,465.)

15,002. Sparking plugs for internal-combustion engines. C. Blandin. September 29th, 1917. (120,202.)

15,123. Automatic or semi-automatic exchange telephone systems. D. A. Christian. September 17th, 1918. (131,487.)

15,433. Electro-magnetic switches. British Thomson-Houston Co. and H. C. Hastings. September 23rd, 1918. (131,490.)

15,500. X-ray apparatus. British Thomson-Houston Co. (General Electric Co.) September 24th, 1918. (131,491.)

16,491. Means for controlling alternating electric currents. British Thomson-Houston Co. (General Electric Co.) October 10th, 1918. (131,499.)

18,594. Registration of telephone calls. Siemens Bros. and Co., W. H. Grinstead and T. Pettigrew. November 13th, 1918. (131,519.)

21,298. Apparatus for electrically-controlling railway signals. A. Monard. December 20th, 1917. (121,744.)

21,350. Sound collecting and intensifying devices for microphone transmitters. P. V. Summer. December 20th, 1918. (131,531.)

21,634. Processes for electric welding. J. B. Murray. March 22nd, 1918. (124,416.)

1919.

2,663. Railway electric track circuit systems. W. R. Sykes Interlocking Signal Co. and R. W. Tarrant. February 3rd, 1919. (131,543.)

3,683. High-voltage windings embedded in grooves or slots. Akt.-Ges. Brown Boveri et Cie. May 24th, 1918. (127,234.)

4,222. Self-regulating dynamo-electric machines. W. Holt and Brolt, Ltd. February 20th, 1919. (131,549.)

5,574. Wireless signalling systems. British Thomson-Houston Co. (General Electric Co.) March 6th, 1919. (131,553.)

8,909. Radio-telegraphic transmission systems. W. J. Mellersh-Jackson. (A. Taylor.) April 8th, 1919. (131,561.)

13,181. Electrical replaceable fuses. M. H. Goldstone and J. Lightfoot. May 26th, 1919. (Addition to 121,651.) (131,574.)

The Industrial League and Council.—The Industrial Reconstruction Council and the Industrial League, which are amalgamating under the new title of the Industrial League and Council, have arranged a series of fortnightly conferences, dealing with the working of Whitley Councils, set up in the following industries:—

Road transport, silk, wool and allied textiles, pottery, building and gloves. The first of these conferences will take place on September 30th, at 6 p.m., in the hall of the Institute of Journalists, when Mr. G. A. Dutfield, J.P., and Mr. E. Bevin, J.P., representing respectively employers and workers in road transport, will give short addresses, and discussion will follow. Whitley Councils affect nearly 5,000,000 workers, and all who are interested in the movement are invited to attend. A similar series of conferences on Scientific Management will take place in the same hall on alternate Wednesdays, at 5.30 p.m. The first of these will be held on 8th October, when addresses will be given by representatives from the managerial staff and workers of Messrs. A. Lloyd & Co., tin-box and canister makers, Cheapside. Admission to the series is free; no cards are necessary.

A series of fortnightly lectures on Industrial Problems will be delivered at the Guildhall, at 4.30 p.m., commencing on October 7th. The speakers will include Mr. E. J. P. Benn, Prof. Ripper, D.Sc., C.H., Dr. Russell Wells, the Right Hon. Sir Auckland Geddes, M.P., Sir George Paish, and the Right Hon. Lord Emmott, G.C.M.G., G.B.E. Tickets for this series can be had on application to the Secretary, Industrial League and Council, 66, Victoria Street, S.W. 1.